MANAGING DEPARTMENTAL KNOWLEDGE THROUGH AN OPEN SOURCE E-PORTAL

GAN SEE LENG

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ABSTRACT

The purpose of this research is to analyze whether an open source knowledge management e-portal can be used to manage, share, retain and capture the organization or departmental knowledge which could be lost due to retirement, resignation of employees or improper management of knowledge. There is no specific definition of what organization or departmental knowledge is but generally it can be described as the knowledge sourced from the organization or department which are held by its employees or are recorded in some materials such as books, documents, logs and etc.

Many organizations do not know what their organization or departmental knowledge is or what they know as their knowledge is poorly organized and often disappears in archives or lost forever. This research which uses empirical research methodology that based its results on observation and experiment was done on 10 employees working in data centre at NTTMSC Sdn Bhd, Cyberjaya.

The research shows that open source knowledge management e-portal can also be effectively used to manage, share, retain and capture the organization or departmental knowledge.

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Gan See Leng

Faculty of Computer Science and Information Technology

University of Malaya

50603 Kuala Lumpur,

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LIST OF ABBREVIATIONS

PHP	PHP Hypertext Preprocessor
HTML	Hypertext Markup Language
CSS	Cascading Style Sheets
MySQL	My Sequential Language
APQC	American Productivity and Quality Centre
SECI	Socialization-Externalization-Combination-Internalization
IT	Information Technology
KM	Knowledge Management
ROI	Return on Investment
GDP	Gross Domestic Product
OPP3	Outline Perspective Plan
ICT	Information Communication Technology
MSC	Multimedia Super Corridor
HP	Hewlet-Packard
DFD	Data Flow Diagram

CHAPTER 1

INTRODUCTION

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INTRODUCTION

Now, countries around the world are looking for ways to change their economy to be more knowledge intensive. Malaysia has transformed itself from a country that rely on

agricultural commodities and mining to an industrialize economy where manufacturing and services now account for 36 percent and 59.7 percent of GDP respectively, (Department of Statistic, 2007).

Manufactured goods particularly electronic products accounted to about 80 percent of Malaysia's export (Department of Statistic, 2007). In Malaysia's Third Outline Perspective Plan (OPP3), 2001-2010 (Economic Planning Unit Malaysia, 2001), the former Prime Minister of Malaysia, Tun Dr. Mahathir highlighted the great importance of developing a knowledge based economy or K-Economy to remain competitive in this globalized world. Therefore, the Multimedia Super Corridor (MSC) project to build a knowledge based economy was launched.

A knowledge based economy will mean that the knowledge will become an important factor in productions, in addition to land, labor and capital requirements. Traditional methods of production will be transformed by using smarter processes, more skilled workers and supported by a broader and richer base of research and development.

When moving towards K-Economy, Malaysia has increased its focus on human capital and information communication technology (ICT) as outlined in the Economic Planning Unit Malaysia (OPP3) in 2001. There is a need to develop the human resources to produce a more competitive and innovative workforce. A study conducted by KPMG Management Consulting (1998) showed that in over 40 percent of the cases it examined in the organization, the leaving employees from retirement and resignations have the highest caused of loss of clients, suppliers and also the lost of best practices or knowledge in the organization. This had directly caused the lost of money to the organization.

Therefore, there is a need to find ways to manage the organization or departmental knowledge and retain this valuable knowledge before it is lost forever. An effective knowledge management will allow people to learn from the past and make good decisions and apply the lessons learned for solving complex choices and future decisions (Dhar et al. 1997).

1.1 Problems Statements

This research identified some points that can cause the knowledge lost in an organization or department as below.

- Leaving employees to another place: The leaving employees to another place tend to bring along their knowledge when they left the organization or department. This directly poses a threat to the organization where the know-how is also lost. Efficiency may also be lower than before when there is no qualify and efficient workforce in the organization or department.
- Retirement of workforce: Retirement of employee from the organization also will cause the same problem as the leaving workforce. All these valuable knowledge are lost when they are no longer in the organization.
- No knowledge sharing in the organization or department: Without the employee sharing their knowledge, it caused the knowledge lost in the organization or department. Knowledge sharing has become quite a challenge for the management because the employees who work in the department or organization may not be willing to share their knowledge after they have completed certain tasks. In order to make this successful, both the management and the employee must agree and work together to promote knowledge sharing among the employees and must be willing to allocate extra resources and time for the

initiative. The open source e-portal can also provide a new chance for fresh employee to access information of more experienced employee. This does not only retain the content of the source, but also the links to the sources of the co-creator while they are still around.

- Difficulty in finding the right information: Besides that, difficulty in finding the appropriate information when needed is quite a challenge for the workforce as precious times were wasted searching these information. If there is no proper place or path where this people can do their critical searching for information in the organization or department, it would be difficult to increase the efficiency of workforce in the organization. Current intranets and internet based consumer's portal such as Google (http://www.google.com) or Yahoo (http://www.yahoo.com) have proven to be insufficient as a measure for the challenge of providing immediate knowledge access to the employees as they contain too much irrelevant information and making the relevant knowledge needed for that specific task in that organization hard to find. This open source e-portal solution can close the gap and they represent a concrete realization of existing theoretical knowledge management approaches.
- Difficulty in maintaining the ever increasing information: The organizations or department also face the tedious task of maintaining their ever increasing data and information which gathered daily, monthly and yearly. Information gathered in the organization or department have become so complex that their knowledge become fragmented, extremely difficult to locate, inconsistent, redundant and hard to share among the employees for decision making (Zack et al. 2004).

1.2 Research Objectives

Knowledge management is a well researched area and this dissertation would like to prove that open source knowledge management e-portal as an alternative solution that can be effectively used to manage, share and retain these organization or departmental knowledge. Besides that, some of the objectives of this research are listed below:

1. To study knowledge management, knowledge retention and knowledge sharing in organization or department.
2. To identify what are the potential knowledge attrition and critical knowledge in an organization and how this knowledge management works.
3. To design and implement an open source knowledge management e-portal.
4. To test whether the open source knowledge management e-portal can be used to solve the problems of managing knowledge in the organization or department.

1.3 Scope of the Dissertation

The focus is about managing organization or departmental knowledge through an open source e-portal as solutions to the problems described earlier.

The open source knowledge management e-portal is built using the current web-technologies and databases such as HTML, PHP and MySQL database. Other in-depth programming knowledge is obtained from the internet, journal papers, books and newspaper articles.

The e-portal is designed to operate in Microsoft Windows platform or UNIX/Linux platform but because of time constraints, the Windows platform has been chosen for deployment instead of the UNIX/Linux platform. The system built has its own

limitations and weakness and is subject to future changes or enhancements for correction.

1.4 Significance of the Research

The significance of this research is solving the problems of knowledge loss in organizations or department due to retiring of employees, resignation of employees or mismanagement of knowledge in the organization or department. These employees bring along their valuable knowledge while leaving the organization and have caused tremendous loss of intellectual property and money to the organization.

The proposed solution for the problems mentioned above will be an open source knowledge management e-portal which can manage, retain and share the organization or departmental knowledge.

1.5 Research Methodology

This dissertation will use empirical research methodology which is based on findings through direct or indirect observations and experiments of the reality for answer. This dissertation will find out the interaction between the targeted users and the open source

knowledge management e-portal. The methods by empirical research used in this research are interview's questionnaire and evaluations form.

Before the implementation of the open source knowledge management e-portal, interviews form will be given to the targeted testers to fill up where this information will be used during the analysis and design phases and at the end of the testing period, the targeted users will be given a evaluations form to fill up. The data gathered from the evaluations form will used in statistical analysis later.

1.6 Dissertation Organization

Chapter 1 introduces the background to the topic and states the problem statements as well as the objectives and scope of this dissertation.

Chapter 2 presents the literature review and also provides an insight into the knowledge retention stages in a typical knowledge management system. Further it also discusses the critical knowledge and knowledge mapping methods and approaches to capture and transfer knowledge. At the end of chapter 2, discussion on knowledge retention's structures and roles and also a review of some critical success factors in knowledge management concludes the chapter.

Chapter 3 covers system analysis of the knowledge management e-portal which include the hardware and software tools requirements.

Chapter 4 put forward the system designs that touch on user interface design, system framework, systems functionality design, process and data flow diagrams, and explanations on the open source applications used in the systems.

Chapter 5 discusses about the system implementations of the open source applications and other know-how to implement it.

Chapter 6 focuses on the systems evaluation which touches on the results and details of samples, sampling techniques and the statistical analysis for evaluations.

Finally, conclusion and possible future enhancements are discussed in the Chapter 7. This chapter includes the discussion on the weaknesses and limitations of the system which may be improved or enhanced for future research and development.

CHAPTER 2

LITERATURE REVIEW

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

According to Cambridge dictionary (http://dictionary.cambridge.org), knowledge is defined as an understanding of or information about a subject which has been obtained by experience or study, and which it is either in a person's mind or possessed by people generally.

While the famous scientist Albert Einstein said, "Knowledge is an experience, everything else is just information" Blair (2004). The working definition of knowledge suggested by Prusak (1998) is "Knowledge is a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of the knower.

In an organization, the knowledge is often becomes embedded not only in documents or repositories but also in the organization's routines work flows, processes, practices and other norms (Davenport et al. 1998).

2.1.1 Knowledge Management

During the 1990s, knowledge management emerged as a major industrial trend that was capable of generating consulting revenues and business value according to Friedmann (2004). In the process of implementing a knowledge management system in organization or department, one of the choices to be made is what tool will be used.

Knowledge management can be defined as a systematic process of connecting people with each other and some of its main activities are to enhance performance through identification, validation, capture and transfer of knowledge (http://www.apqc.org).

This definition may not be accurate and differs significantly depending on the context and the organization structure. Knowledge management as a term has only been around since the early 1990s.

The definitions of knowledge management stated below are from some well known leaders in the field of knowledge management.

- Knowledge management is a discipline and technology enabling people to share their knowledge through agreed-upon processes for identifying, capturing, storing, retrieving, creating and evaluating an organization's information assets. These assets include the un-captured, tacit expertise and experience within individual people, and the databases, documents and e-mails in an organization, (Bair et al. 2004).
- Dr.Yogesh Malhotra of Brint Institute gives some answers to what is knowledge management by saying that it is about "obsoleting what you know before others obsolete it and profit by creating the challenges and opportunities others have not even thought about" Malhotra (1997).

- According to Melissie (2002) of Buckman Laboratories, who is a leading knowledge management pioneer defines knowledge management as “focuses on how an organization identifies, creates, captures, acquires, shares and leverage knowledge. Systematic processes support theses activities, also enabling replication of success. All of these are specific actions organizations take to manage their knowledge”.

- According to The American Productivity and Quality Centre (2003), leader in knowledge management research and dissemination notes that knowledge management as “systematic approaches to help information and knowledge emerge and flow to the right people at the right time to create value”.

2.2 Types of Knowledge

What is knowledge? According to The Confucian Analects, book 2:17 “When you know a thing, to hold that you know it; and when you do not know a thing, to allow that you do know it – this is knowledge”.

It is important to understand that there are two types of knowledge which are explicit knowledge and tacit knowledge while some people may also try to argue the points of differences between tacit knowledge and explicit knowledge.

2.2.1 Explicit Knowledge

Explicit knowledge is the type of knowledge that is formally documented and codified in a tangible format such as the information in databases. In an organization or department, this type of knowledge can be found in the items listed below:

- Research and development such as research data, research findings and white papers which is the detailed of certain matters.
- Policy manuals such as insurance policy manual and etc.
- Project management such as project milestone, project analysis, project diagram and work flow.
- Formulas such as mathematic equations, engineering drawing, engineering process and technical documents.
- Books, e-mails, product information, problem solving procedures and technical documents.

Explicit knowledge may not be useful without the context provided by the experience user. Although this explicit knowledge can be easily available, it only works best when combined with tacit knowledge.

Some of the best practices that an organization or department can use to get this knowledge are from collaboration tools such as teleconferences, chat-rooms, document management systems, content management systems, shared folders or drives in a computer networks, decision support systems and knowledge maps.

Besides that, expert systems or artificial intelligence, e-portal, case-based reasoning system and employee development programs can also be used to capture the explicit knowledge.

Figure 1 shows a comparison of extent of use and effectiveness of approaches for capturing explicit knowledge based on feedbacks from organizations.

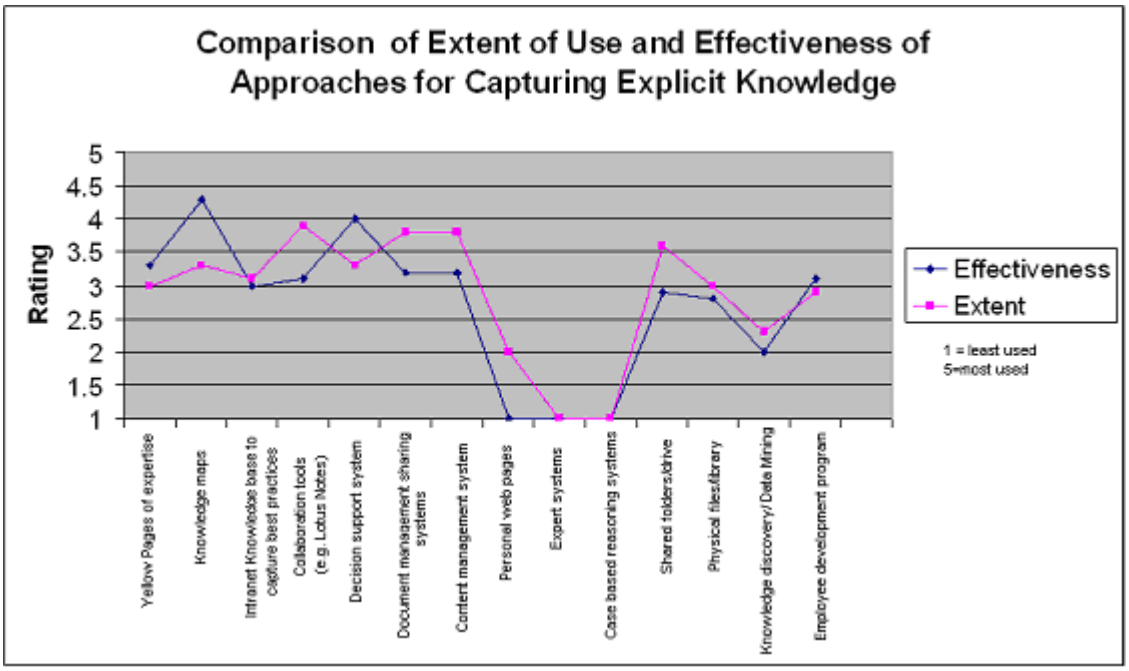

Figure 1: Comparison of Extent of Use and Effectiveness of Approaches for Capturing Explicit Knowledge. (Source: Knowledge Management, Ark group)

2.2.2 Tacit Knowledge

Knowledge can emerge in the minds of the people through their experiences and also jobs, Ikujiro (2003). It is more feasible and economical to capture the knowledge before the knowledge is lost and latter become critical arguments.

Therefore, one of the best practices for the organization is to cultivate the tacit knowledge before it is lost.

Tacit knowledge is the type of knowledge that resides in people's mind which can help them to work, but cannot be easily documented and difficult to be transferred to others without any contacts, Penin (2005). This knowledge tends to hold more values and meanings compare to explicit knowledge but it is also more difficult to be managed.

Tacit knowledge is hard to be catalogued or to put in document with detailed as it is results from experience and learning. It is based on common sense and requires rules and processes and not just data. Some of the methods to capture tacit knowledge are listed below.

- Communications
- Documentation of workflow.
- Interactions with people
- Internal networks and meetings, briefing and dialogues
- Course training, workshop, apprenticeship and mentoring
- Videotaping and teleconference
- After-Action reviews and project milestone reviews.

2.3 Basic Implementation Stages of Knowledge Management

Building a knowledge retention strategy can be a complicated task. Starting from the right path is often difficult and staying on the right track can be even more difficult when obstacles occurred.

Figure 2 illustrates the basic implementation steps or roadmap to knowledge management. Every stage involves unique issues, problems, characteristics, requirements, tools and action steps.

After completing these stages, the organization will maintain sound footing through the entire knowledge management implementation process.

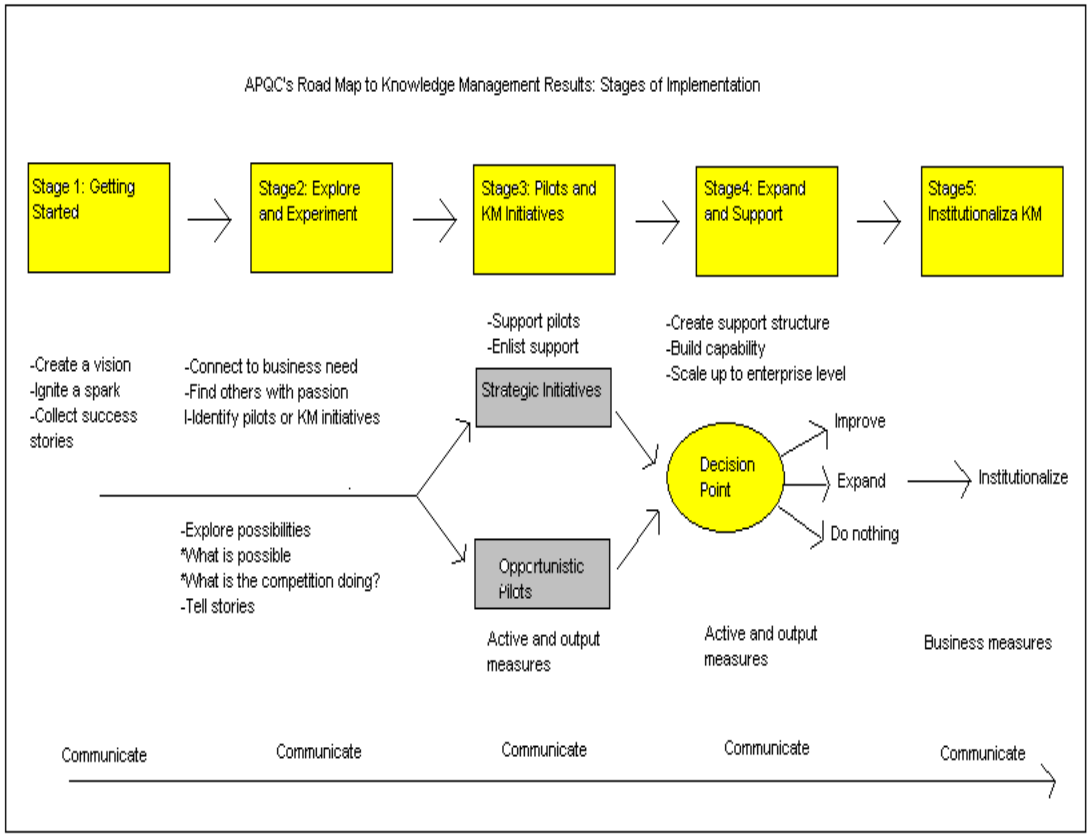

Figure 2: APQC's RoadMap Knowledge Management Results, Stages of Implementation

2.3.1 Starting of Knowledge Retention

Referring to Figure 2, the first step will involve getting senior management supports to explore the concepts of knowledge management and understands the value for the organization.

Therefore, to retain the valuable knowledge, one of the most critical objectives in stage 1 is to increase the awareness of knowledge loss as a strategic issue and to bond these efforts to corporate goals and objectives.

As the leader of knowledge management in the organization, they will search the potential impact of developing knowledge retention strategies, it also highlights the cost of lost knowledge and correlate the value of knowledge management approaches to the mitigation of anticipated costs and loses.

The internal research can access pending knowledge loss in the subject area, and place some economic values on that loss. If the senior management does not support the effort to determine the knowledge loss, other pioneers may want to identify the issues related to knowledge loss other external best practices.

Meeting and discussion with stakeholders can also reveal opportunities as well as solutions to initial barriers and any potential remedies. This is expected by continues and following support or attention to tackle the problems.

2.3.2 Developing Strategy for Knowledge Retention

According to Figure 2, in stage 2 it involves individual interest or local efforts and characterized by the decision to explore potential benefits of organization action. The leaders brought together in Stage 1 may continue to play important role, but within a formalized knowledge management leadership structure.

The original pioneers have successfully layout to senior executive so that they can designate cross organizational leadership and responsibilities and give their knowledge retention strategies.

The main task at this stage is to create a business case that will detail the first iteration of then knowledge retention strategy and describes how knowledge management and knowledge retention efforts complement organizational goals and objectives.

Basically, the formal knowledge retention strategies may follow or focus on objectives describes as below:

- Capturing the departing knowledge
- Capturing the project lessons learned for reuse
- Establishing learning and guidance relationship
- Preventing the loss of technical knowledge
- Building a knowledge sharing culture
- Orienting new hires more quickly

2.3.3 Designing and Launching Knowledge Management Initiatives

According to Figure 2, this stage involves the design and start off of one or more knowledge management initiatives. These earlier project should show that knowledge management will work and will have impact on organizational or department performance.

Therefore, this initial pilot project should be carefully selected and supported to ensure their success. The organization should also address the cultural changes and change management enablers that will ensure wider participation in knowledge sharing activities.

In stage 3, partner organizations use a variety of ways to capture and share the knowledge in their organizations. This different of approaches shows the designed knowledge retention mechanism that fit the particular needs and business objectives for each organization. The knowledge captured from this process must fit in the culture of the organization or department first as this is important whereby the practices and knowledge are transferred effectively and shared their knowledge among the employees.

Employers or management just can not expect the employees to change the way they work without giving them substantial reason for doing so. People's behavior, and hence company's culture, will change when a reasonable quantity of knowledge sharing is articulated and appropriate tools are used.

In a knowledge friendly culture, several principles typically exist as below:

- Knowledge sharing is tightly linked to the core cultural values of the organization.

- There is a strong management and peer pressure for people to collaborate and share.
- Peoples see the connection between sharing knowledge and business purposes.
- Human networks have a facilitator who is responsible for the network and ensures that people participate.
- The rewards and recognition system is aligned with sharing knowledge.
- Knowledge sharing is integrated with people's work through knowledge sharing events and routine work processes.

2.3.4 Expanding and Supporting Knowledge Management

According to Figure2, when the organization reached stage 4, knowledge management has proved to be valuable enough through the pilot project and to get the attention and resources it needed to expand the project.

At this stage, knowledge management is already being considered as a strategic and a necessity for the organization. Each organization must create a structure and dedicated resource to expand and sustain the initial knowledge management efforts. This structure may seem different across the organizations and extra costs and resources for this knowledge management and retention need formal business evaluation and return of investment (ROI) justification.

Stage 4 will see the organization making decision to invest more for expansion and continuous support of knowledge management. This expansion strategy must be in line with the initial pilot project. Another characteristic of this stage is that knowledge retention and sharing are more likely to be built into existing or new business initiatives

such as by adding a knowledge capture component to a Six Sigma process and better measurement systems.

2.3.5 Institutionalize Knowledge Management

Stage 5 will involve embedding knowledge management into the business model and continue to monitor the frequency of knowledge used, captured and shared. The knowledge management team may also act as an internal standard board to look after the progress of implementation across the organization or department.

Most of the organization in this stage will have the characteristics as described below:

- E-portals customized to deliver just in time information matching the preference and roles of individual employees become obvious.
- Knowledge capturing, sharing and reuse are built into work process.
- Knowledge and collaboration are extended more thoroughly to customers and partners.
- Knowledge management is integrated with the organization's learning and human resource development strategies.

2.4 Identifying Critical Knowledge

There are many success stories in knowledge management, making it easier for organizations or department to forget that not all knowledge is worth capturing, storing and sharing. In fact, a knowledge retention initiative's success depends on the organization's ability to determine what critical knowledge is, how people could benefit

from using it in a different way and whether the value of the captured knowledge can be justified.

As it goes on, an organization or department can have a huge storage of information in its database or filling it in files of cabinets. Capturing an organization or department's past, although a beneficial starting point for most peoples, is not necessarily the best way to spend limited resources. To the worst scenario, a system flooded with useless information will discourage potential participants.

Some of the key steps are to conduct a content auditing during the planning and design phases, which are strongly correlated with process improvement, service levels, cost savings, quality of content and customer satisfaction. If that is done, the next step is to select an appropriate approach to capture and transfers that critical knowledge.

Several tasks can allow an organization or department to identify what knowledge is critical and must be preserved. Normally, the senior management will determine what knowledge is critical enough to be captured.

Some of the methods used to identify critical knowledge are interviews with employees in certain roles, discussions with senior management that involve in experts and employee turn over participant surveys and communities of practice. Interviews with employees that are about to leave or depart from the organization may not be an ideal source as it may be too late to capture all the knowledge at the time of leaving.

Figure 3 below show results from a survey of an organization to know which department or function that has the highest knowledge loss.

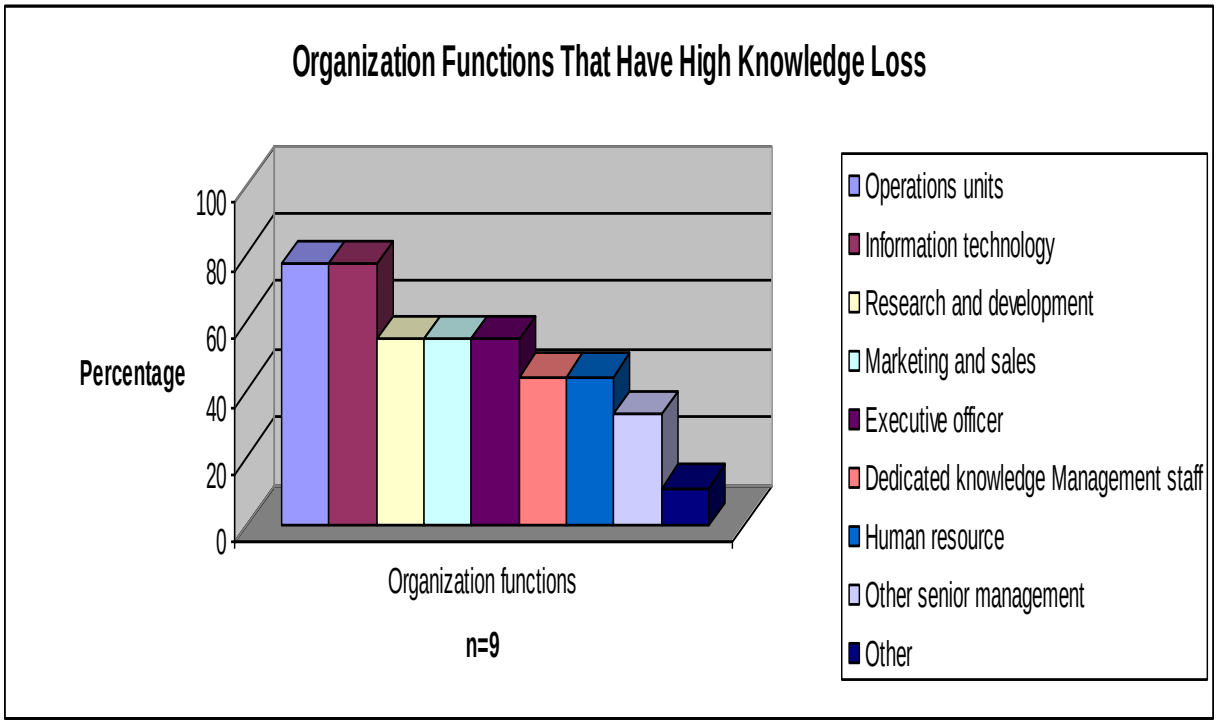

Figure 3: Organization Functions That Have High Knowledge Loss (Source: APQC).

After an organization or department has identified what knowledge need to be retained and who has it, and then they will need to layout some criteria to access the value of the knowledge. Some of those criteria can be stated as below,

- The relevance of the knowledge to the business strategy
- Uniqueness of knowledge from other knowledge.
- Usefulness of the information to customer and staff
- Standard operating procedures.

2.5 Methods to Retain Knowledge

To retrieve critical knowledge, an organization or department must understand how information flows internally. Knowledge mapping outline the relationships between the

knowledge provider and the receiver. By mapping out the knowledge, Carter (2004), it shows who the creator of that knowledge and who the knowledge were intended for.

Knowledge mapping is dynamic and instead of mapping the entire domain, it is much better to simply generate a map for a key flow area. These key flow areas will have its own focus area and the next step is to map the processes by determining the routine and non-routine tasks.

Interviews can help determine the knowledge pathways through the organization or department. From the maps created by the knowledge provider, an organization can determine what knowledge its employees need, where and whom they get it from and its usage. It also reveals all the factors or criteria that enhances or impedes the flow and sharing of knowledge.

2.5.1 SECI Model

This is no single approach that can provide comprehensive solution to knowledge capture and transfer. The approaches best suited for the knowledge management rely entirely upon the type of knowledge an organization wants to capture and share, and also the culture of the organization.

According to Nonaka and Takeuchi's Socialization-Externalization-Combination-Internalization (SECI) model, knowledge is dynamic and tacit or explicit knowledge go through a knowledge conversion.

During this conversion, both tacit and explicit knowledge expand in quality and quantity as shown in Figure 4. This conversion goes through 4 modes as below;

- Socialization – from tacit knowledge to tacit knowledge
- Externalization – from tacit knowledge to explicit knowledge
- Combination – from explicit knowledge to explicit knowledge
- Internalization – from explicit knowledge and to tacit knowledge

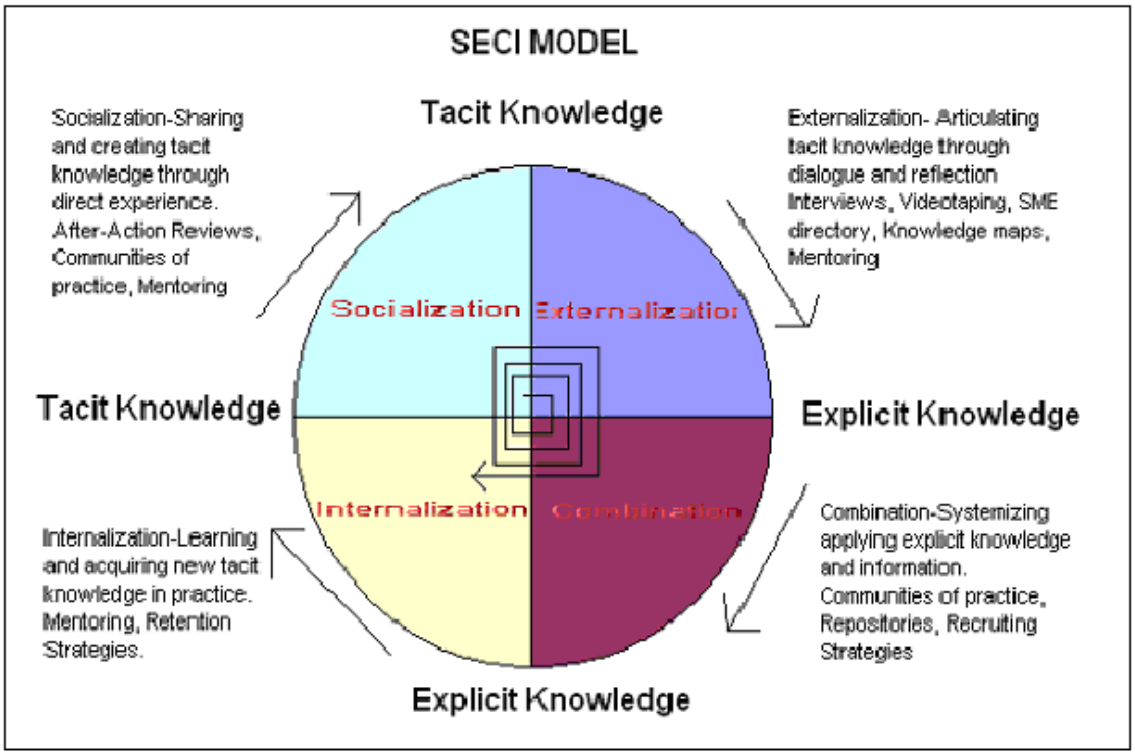

Figure 4: SECI Model

2.5.2 AAR and Project Planning Process

The After-Action Review (AAR) is a technique created by the United States Army which provides teams with feedback by reflecting on their activities with a focus on performance standards. By using the feedback, the organization or department gains

experience and direct lessons learn. This would enable them to learn its strength and weakness in performance.

The greatest value from After-Action Review is its tacit transfer of knowledge during the post activity review. Figure 5 shows the After-Action Reviews and the Project Planning Process.

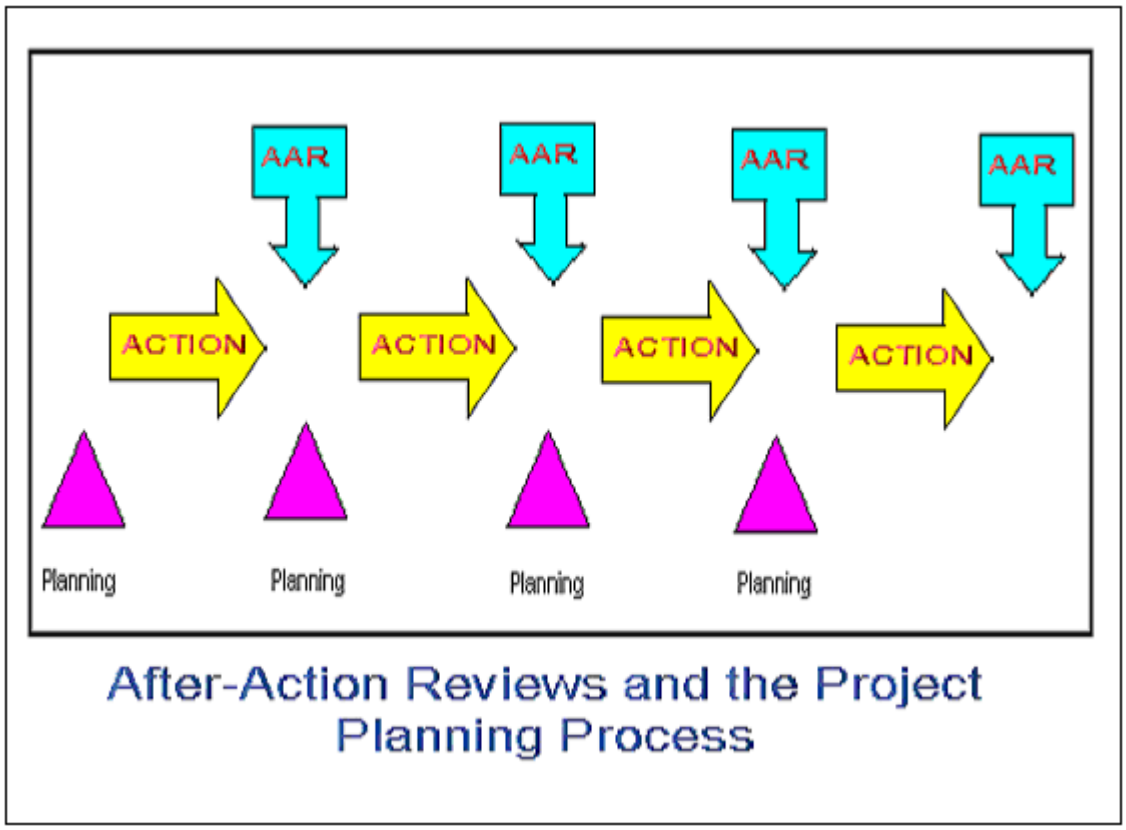

Figure 5: After-Action Reviews and the Project Planning Process

2.5.3 Mentoring

Mentoring allows the transfer of knowledge from experienced employees to new employees in the organization or department. This mentoring will cover the skill development, behavior and leadership practices. Orientation can introduce the

organization or departmental's culture while specific job tools can allow explicit knowledge transfer.

A good mentoring relationship gives benefits to both parties by expanding their knowledge, creativity, energy and skills. For the purposes of knowledge retention, mentoring programs effectively transfer knowledge from leaving employee to successor.

Organization or department that uses internal mentors usually look to their high or middle top level managers for the mentoring task, while external mentors are those who were successful in their profession. Mentors and students must be given free space to meet regularly and share their information both in formal working environment as well as informal environment.

The success of a mentoring program is hard to measure in resolute terms. The transfer of tacit knowledge is difficult to codify in its entirely and the only ways of measuring the effectiveness of a mentoring relationship is either by measuring the retention rate of employee in that organization or by the success of the student after mentoring.

2.5.4 Interviews

The methodology that we learnt for extracting knowledge was very practical and easy. In a simple interview, we could gather a lot of knowledge on what that person does. (Corbett et al. 2003).

Interviews are usually conducted during a project review session or before the departure of an employee from the organization or department. This can be an effective way of capturing tacit knowledge. Even though the information in an interview is in verbal form, it can be translated and stored in a database or repository for future uses.

During the interview, videotaping can be used as an option to capture more of the context, as well as tone and body language of the interviewee. After that this video tape can be indexed and delivered online.

Figure 6 below show the types of interviews that can be conducted for knowledge retention purposes.

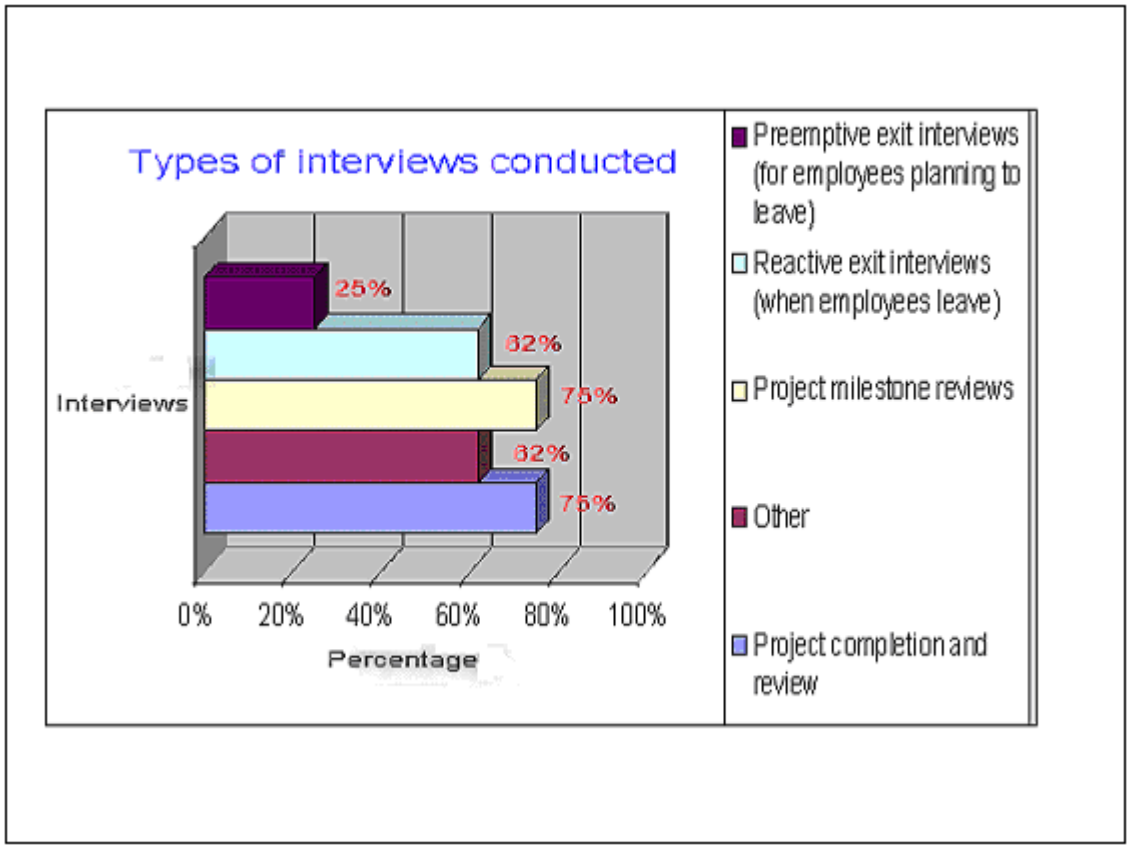

Figure 6: Types of Interviews Conducted

2.5.5 Communities of Practice

Communities of practice are defined as groups of people who share and learn from one another face to face or virtually through tele-conferencing, messaging and etc. They are held together by a common interest in body knowledge and have the tendency to share problems, solution, experiences, insights, templates, tools and also best practices.

Many people mistakenly believe that electronic or online interaction is enough to form relationships among the employees but this is not true. The best practice is to have the communities meet at least one or twice a year if not more regularly, faces to face so that all the members know each other.

As the community captures knowledge, a repository should be designed to store the community's explicit knowledge so it can be disseminated across the organization.

When the communities become closer part of the organization or department, it begins to create a more knowledge sharing society and this approach capture and transfer existing critical knowledge. It also becomes an important resource for realizing new competitive advantages.

2.5.6 Expert Directory

An expert directory is used to locate experts both inside and outside the organization or department. Its function is similar to the yellow pages which primary use is for the exchange of tacit knowledge. These tools allow access to human, rather than to

information, to enable an actual conversation or e-mail exchange that provides the context for information.

The existing human resource system which uses word processing document or spreadsheet will need to covert the data captured to a relational database so that the information can be sorted and linked to their topic of expertise.

If the expert directory exists in human resource system which usually defines as expert locator system, the system's capabilities should be extended to include areas of expertise. This area of expertise is linked to the skills of the employee.

2.5.7 Repositories

According to IDC's Worlwide Quartely Storage Software Tracker in 2006, EMC and Veritas posted the strongest results among the top five vendors, with 30.5 percent and 23.4 percent year-over-year growth respectively. These companies' core business is mainly involved in providing data storage.

Database hold information while repositories hold structured content that include a portal that structures and categories knowledge. Building knowledge repositories requires the codification of knowledge. In codified form, knowledge can be easily stored and reused, Chua (2003).

Serving as an organizational memory, knowledge repositories enable organizational members to retrieve past knowledge, Markus (2001). Without these repositories, it is very hard for the employee to fuse knowledge with the isolated database. Repositories are mainly used to capture explicit knowledge.

These databases contain in the repositories may keep the information about customer's information, customer's enquiries, sales presentations, reports, competitor analysis and also competitor intelligence. One of the difficult tasks is to integrate different e-portals and databases together where its repository can capture user data automatically rather than asking the user to enter the information.

Every system needs a good process for creation, evaluation, maintenance, categorization and renewal of information to maintain the information accuracy in the repository. The number of repositories in an organization can be enormous as every project, product, or person seems to require its own repository.

Therefore, it is beneficial to leverage the use of current information before creating new information. A knowledge repository should link to other repositories in the organization so that employees can access many knowledge pools from one spot. If the information is not well structured, it would be hard for the employee to locate the information that they are looking for and the repository will fail in delivering its task.

2.5.8 Electronic Mail

“The explosion of e-mail and more items have caused major headaches for business, especially as transactions are increasingly conducted via e-mail and more items are digitized”, Cadwell (2004).

E-mail is a limited way and most frequently used approaches for knowledge transfer and knowledge sharing. For knowledge sharing, it is widely considered only moderately effective because it acts as a tacit knowledge transfer tools where the information that is written down are not categorized or stored in a common repository.

Nonetheless, e-mails are an effective knowledge sharing tools unlike other approaches where they are used daily and are often mainly event-driven.

2.5.9 E-Portal

E-portal can be used to capture, retain and manage the organization or departmental knowledge. Combining the content management systems such as drupal and the document management systems such as KnowledgeTree into the e-portal will become a good knowledge management system.

Basically it the e-portal for knowledge management should have the following features;

- Taxonomy: The open source e-portal allows all content to be categorized into taxonomy trees. Allowing for hierarchical categorization of all types of content. For example, all content from departments can be categorized into categories “department a” and “department b”. But it can also be categorized on

knowledge. Building a general knowledge trees will allow one to cross reference to certain categories.

- Books: Each pieces of the content can be arranged in a hierarchical book, creating a dynamic table contents, and allowing a content flow. Each article may have follow-up, predecessors and children or parents. There is also a standard "search" that allows for keyword searching. This search can return users, contents or comments with applied keyword.
- Revision Control: The open source e-portal allows all articles to have revisions. Those can be rolled back when mistakes are made, or can be used to track the history of certain piece of knowledge.
- Commenting: There is a flag function in this e-portal where all articles can be flagged to allow commenting. Therefore, outside and inside input such as additions or corrections on knowledge are possible.
- Blogging: More than often, the workflow of an organization may require some quick input of small snippets of knowledge. So in this e-portal, a blog is a good form for this type of knowledge and it can be categorized, searchable and bundled per author personal blogs.
- Distribution: This e-portal has different category with its own feeds. This allows interlinking of knowledge between several knowledge bases.
- Aggregation: This e-portal allows importing knowledge from other feeds and these feeds can be bundled and categorized.
- Discussions: A discussion board, poll and forum where employees can share their opinion and knowledge among them.

2.6 Knowledge Retention Structure

Knowledge retention, like knowledge management needs a support structure where this support structures vary from organization to organization but basically there are three critical elements presented in a successful knowledge retention initiatives as described below:

- Senior management support
- Central knowledge management supports
- The involvement of various business units or functions

2.6.1 Senior Management Support

Senior management support plays a critical and significant element in knowledge retention initiatives. The team can be made up of members of senior management and steering committee members who will validate knowledge management and retention activities.

The steering committees minimize the barriers and promote knowledge sharing throughout the enterprise and also make sure the business units, corporate and IT are working in the same direction with the same scope.

2.6.2 Advisory Board

The advisory board is a cross functional team with senior level executives and advisers. The advisory board directs the strategic alignment, resolve knowledge management issues and needs, support communities of practice and promote collaboration methods for transfer of high value tacit knowledge.

Inside this highly visible responsibilities are the functions to create, capture and leverage knowledge management best practices and approaches and also promote and encourage the common processes for knowledge access and management.

2.6.3 Central Knowledge Management Group

Organizations or departments rarely have a separate knowledge retention and implementation team which comprises the core knowledge management team, human resource, training personnel, IT personnel and business owner to manage the actual design, development and deployment of knowledge retention and knowledge sharing initiatives.

Not forgetting the role of information technology department which supports and involves in the knowledge management group and continue to provide technology readiness after the knowledge management system being deployed. Business owners are frequently involved in the knowledge management group because they see the need to prevent the loss of critical knowledge to its business knowledge.

2.7 Knowledge Retention Roles

2.7.1 Core Roles

Knowledge retention roles can be included in two areas which are core roles and approach roles. In core roles, the teams that make up of these are

- Knowledge management team members
- Leader

- Training personnel
- IT personnel
- Business owner or product group representatives
- Content managers.

2.7.1.1 Knowledge Management Team Members

The knowledge management team members support different business owners in their knowledge retention efforts through meeting, technology development, advice and personnel support.

2.7.1.2 Leader

Leader will be responsible in the layout the strategic direction and investment for the knowledge management team.

2.7.1.3 Training Personnel

Training personnel can align strategies; provide training and information update for the knowledge retention.

2.7.1.4 IT Personnel

Information technology can be main catalyst in technology area of knowledge retention. IT personnel enables immediate answers to any information related question or request while maintaining the knowledge users.

2.7.1.5 Business Owner or Product Group Representatives

This group can familiarize the knowledge management team with the experiences of outward facing groups and generate buy-in and visibility for the various knowledge retention approaches on the front lines.

2.7.1.6 Content Managers

The content managers will maintain and support the repositories and also content management systems. They will also maintain the security classification and records management procedures.

2.7.2 Approach Specific Roles

The approach specific roles are developed specifically for certain function only and not needed all the time. For example, a database administrator will only be needed for updating or querying the database. Below are some of the positions and roles that may support the central knowledge management groups when needed.

- Database administrator
- Business owner
- Project manager
- Administrative support
- Taxonomy specialist
- Subject matter expert
- Interviewer
- Video cameraman

2.8 Critical Success Factors

A substantial part of knowledge management literature is devoted to knowledge management in the context of organization (Edwards et al. 2003).

Knowledge management has been described as the process of creating; capturing and using knowledge to enhance organizational or department's performance, Bassi (1998). Knowledge retention effort depends a lot on the organization's readiness and initiative to share the knowledge.

Most of the retention efforts will need employee's participation and awareness of the reason of working in certain way as a mean to capture and retain knowledge to improve the working process.

Some of the enabler that are used to promote and enhanced knowledge sharing and retention are as below;

- Formal consent and support by the senior management
- Awareness and communication – employees participate and seeing each other as word of mouth communications are involved
- Involvement in communities of practice- provide a platform for knowledge capture and transfer
- Use of training function.- will build the employee knowledge and skills

Besides those enabler mentioned above, there are others critical success factors that involved in the knowledge retention implementation, some of them are stated as below, DavenPort (1998).

- Executive support in the knowledge retention
- Communication in the organization
- Rewards and recognition in the organization.
- Human resource involvement in the knowledge retention.
- Collaborative working environments in the organization.

2.8.1 Executive Support

Executive can support and increase the pace of the organization or department's implementation of an effective knowledge retention initiative. Basically, the grassroots initiative takes at least a few years to develop where time are needed to build the business case and secure all the resources that it needs, Parlby (1997).

2.8.2 Communication

Clear communication is one of the important and crucial enabler in the implementation of knowledge retention. A strong management support provides an incentive for people to collaborate and share their knowledge.

It is important to know who must receive the communication message or ideas and one of the good practices by the organization or department is to use the company's media to disseminate the messages and cascade the communication plans through out the organization or department.

2.8.3 Rewards and Recognitions

Employees who shared and retain knowledge can better perform their jobs and therefore entitle to receive recognition as key contributors. Organization or department needs to build a more rewarding systems to promote and encourage more employees to adopt this knowledge sharing and retention culture.

A practical and standardized reward system may help realized the practice into the common working culture and repetition is rewarded as a result. Most of the time, human want status and would like to be rewarded for what they know. This recognition for them as an expert in their own field give them satisfaction and enjoyment.

By attaching the author's name to certain documents, presentation or articles can be a method for them to feel rewarded when they share their knowledge. The knowledge management system that is designed for the employee has to be self-rewarding where the users can get something out of it; could it be knowledge they wanted or a sense of status and recognition. Direct rewards are never effective and rarely as valuable as the rewards embedded in the activities it self.

2.8.4 Human Resource Involvement

Good practice in an organization or department will try to build partnerships between the human resources functions and core business strategies. If retaining and sharing knowledge is a key feature of the human resources system, knowledge management activities will demonstrate below tasks in the human resource;

- Increase and foster organization learning
- Increase internal and external organizational training

- More new recruiting and retention program
- More mentoring and counseling program
- More rewards and recognitions program

2.8.5 Measurement

A measurement is important to know the progress of the knowledge retention activities. It can also provide deep information about the strategies for achieving its goal. In every stage, measurement can be done on the desired behaviors and this mainly is the responsibility of the knowledge management team.

The most effective method to measure the success of knowledge retention is to track activities in which knowledge is captured. Besides that, tracking the number of interviews and giving user surveys are also effective methods.

Tracking requests for information and hits on the knowledge sharing e-portal and conducting surveys also help to access the effectiveness of knowledge retention initiatives.

2.8.6 Collaborative Working Environments

Effective physical offices changes in an organization or department is a way to improve knowledge sharing, team productivity, collaboration and communication among employees and better use of space.

2.9 Why needs a Knowledge Management e-Portal?

Rampant employees resigning to join other organizations and the issues of retirement have caused the organization to take this serious action against the problems. They will be worry to find the best method to keep the employee's knowledge from departing the organization and lost forever.

The continuous changes in the organization are normal but impending mass retirements will generate losses of invaluable knowledge if those who hold the knowledge are allowed to simply walk away.

Organization does not have to be panic, as they can use the most easily available strategy to capture this critical knowledge before it walks out the door of the organization. Traditional approaches could hardly meet the requirements to solve the problems and the latest concept of web based knowledge management e-portal has proven to be very effective and suitable to retain this valuable knowledge. The acceptance of these new concepts by employee will take time as illustrate by the co-evolutionary cycle in Figure 7.

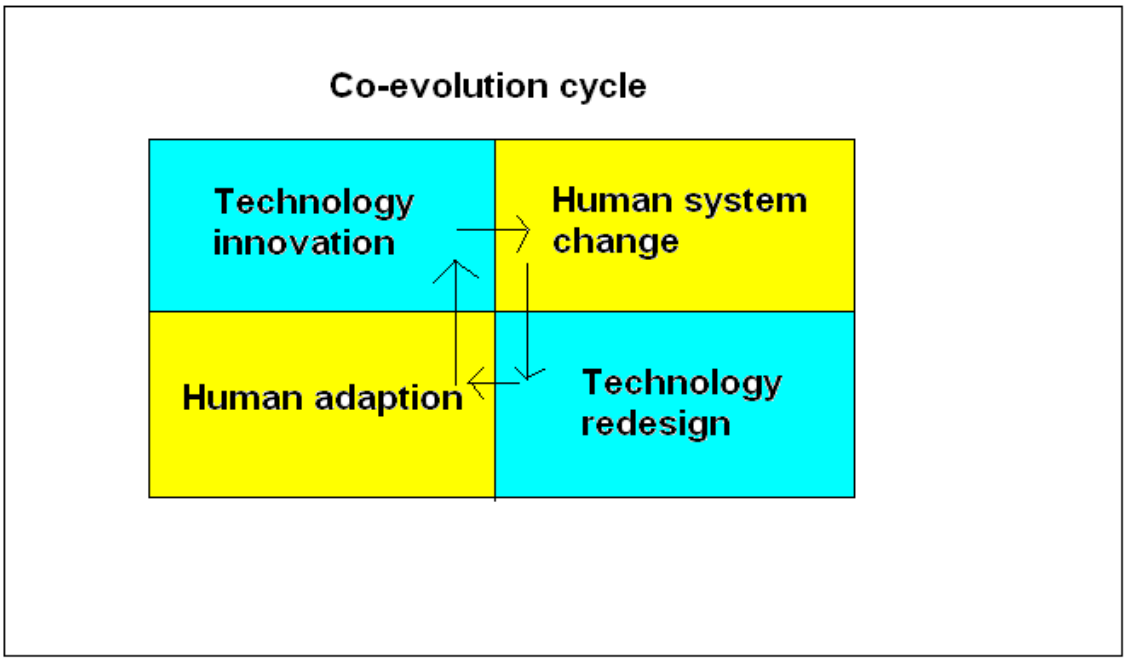

Figure 7: Co-evolution Cycle

The cycle started with technological innovation such as the emergence of the web, and will be followed on by human changes where the web becomes a generally required system in the organization as well as private use and then technology re-design where the web is exploited for organization's use as adaptation.

Once the web itself being widely accepted, further innovation will occur and continue the human system changed.

Web based knowledge e-portal is flexible and easy to use, and can provide almost any kind of contents or functionalities. Besides that, the knowledge management e-portal is important as it can tackle some of the problems related to information overload, information availability, information integration, knowledge loss or deficiency and common knowledge sharing platform.

2.9.1 Information Overload

As what Peter Drucker described “information is data endowed with relevance and purpose, and it is the individual of that information who will decides whether that information is truly an information or noise”. One of the most persistent problems faced by any organizations in the 21st century is information overload.

There is a lot of information flowing around internally and external to the organization where this information may posts an alarming level to the employees in terms of absorbing, digestions and the effectiveness of using this information.

2.9.2 Information Availability

Most of the time, employees are unable to find the right information that they need and spend a lot of time searching for the information. It is estimated from various studies which revealed that employees spend between 20 to 30 per cent of their time just looking for information from multiple locations, and more aptly, reinventing the wheel and many organization squander between 8 or 12 hours every week, looking for information in this way, Maiden (2004). For large organization, this represents a huge lost in terms of time and money each year.

2.9.3 Information Integration

Big organizations with vast network and computer systems are pack with disparate applications that do not talk with each other as each system has its own way of processing and functioning. To add to this burden, these different systems have been separated with different passwords and protocols for security reasons and just to retrieve a small piece of information which have buried inside this systems will need a lot of unnecessary tasks and this waste a lot of time.

2.9.4 Knowledge Loss or Deficiency

Time is money and reducing the time spends to for new hires and can also reduce the loss of money. This new hires are because of retirement or employees resignation from the organization and this directly reduce the organization's ability to compete and sustain itself in this competitive market. By capturing and baking expertise into people's routine workflows can be part of the solutions, and this can be done with the help of a knowledge management e-portal.

2.9.5 Lack a Common Knowledge Sharing Platform

Nowadays, connectivity tool such as instant messaging is very common in the market which can help people to communicate, know who they should talk to and how to find and locate the gurus in their networks as a way to find answer for their questions. Employees need to know how to get an answer fast and not just by referring to the text documents available on the desk alone. Maybe, colleagues sitting beside an employee may know the answer to the questions but the employee may not even know that they are that close to find the answer and never asked.

Therefore, by adding an expert locator or commonly known as skill directory finder in the e-portal can help the employees to search the information that they wanted. This can be done by linking the employee to discussion groups, forums and blogging.

Sometimes, unknown 'problems' in the organization can also be discovered from listening to the "war" stories about the employee's problems and locating this can offer clues to potential new support services. Employer can also map out the "knowledge-gap" or deficiency if it ever exists among the employees in the e-portal and afterwards, find the solutions.

3.0 Conclusion

In the literature review, it has discussed that knowledge in the organization or department can be separated into explicit knowledge and tacit knowledge. This knowledge will be lost from the ongoing retirement of employees and also those employees leaving the organization or department.

The literature review discussed why it is important to retain that knowledge before it is lost. If the organization or department would like to retain this knowledge, what are the knowledge retention stages available to follow and what to consider as critical knowledge that should be retained in those stages?

Some of the websites studied are Program/Project & Engineering Leadership (http://appel.nasa.gov), An Arbor District Library (http://www.aadl.org/) and Water

Town Massachusetts (http://h2otown.info/). The Malaysian sites studied are SinchewPress(http://ent.sinchew-i.com),Epekak(http://www.epekak.net.my/online/), Al-muslim(http://almuslim.org), Pesilat (http://pesilat.com) and etc.

The dissertation also covered the questions of what roles and who should be responsible in the retention of this knowledge and also what are the factors that determine that the knowledge retention will be successful.

Besides that, it also briefed the available methods and models to retain knowledge such as SECI model, AAR plan, mentoring, interviews, communities practice, directory, repositories and electronic mail but the dissertation suggests that all these approaches to manage and retain the organization and department's knowledge can also be achieved through an open source e-portal. The dissertation has given some reasons why an online e-portal is the ideal answer to retain the organization or departmental knowledge.

Therefore, as a conclusion, there is no doubt that there are many ways to available for managing the organization or departmental knowledge but the best approach is through an open source knowledge management e-portal.

CHAPTER 3

SYSTEM ANALYSIS

SYSTEM ANALYSIS

3.1 Development Environment

To increase the development process and to help generate a timely solutions, this dissertation will select to use an existing open source content management system available from the open source community. On the Internet, some of the available content management systems are Mambo, Typo3, Movable type, Word press, Text Pattern, drupal and others.

In this dissertation, drupal has been chosen to be the building block of the open source knowledge management e-portal. Some of the reasons that drupal is better than others are shown in Figure 8 (please refer to Appendix C). It is the comparison in terms of ease of install, learning curve, session control, user control, extensibility, scalability, themability and xHTML/CSS availability. Besides that, it is announced by Packt Publishing that Drupal has won the overall 2007 Open Source CMS Award after some voting.

Therefore, in Figure 8 (please refer to Appendix C), apparently, drupal is a better content management comparing with other content management system such as mambo, typo3, movable type, word press and test pattern.

3.1.1 Hardware Requirements

This open source knowledge management e-portal is designed to support many concurrent usage form many users and therefore the hardware of the computer system use should have the minimum specifications as below:

- Processor with a clock speed of at least 200 MHz
- 32 MB of Random Access Memory (RAM)
- 20 MB of hard disk space
- A 10 / 100 Base-T network card

3.1.2 Software Requirements

The software used for this dissertation can be divided into two categories which are software used for documentations and software used for system developments.

3.1.2.1 Software Tools Used For Documentations

The software tools used for documentation in this dissertation are Microsoft Word and Dia (http://live.gnome.org/Dia) which is an open source general purpose diagramming software developed as part of the GNOME project's office suite.

Dia has a modular design with several shape packages suitable for flowchart, network diagrams and others. Part of the system documentations would involve producing structure charts, flow chart diagrams, tables and figures.

3.1.2.2 Software Tools Used For System Developments

Table 1 below shows the summary of the software used in developing the open source knowledge management e-portal. Most of the tools are open source software, except Microsoft Words and Microsoft Excel which is proprietary software.

The reason for using open source software is because open source is given free (no licensing fee) and no restriction on using the codes.

Table 1: Software Development Tools Used in the System

Software Name	**Purposes**	**Descriptions**
Windows XP	Operating systems	Operating system for workstation
Apache	Web-server	Programming language
MySQL, phpMYadmin	Database	Database
Drupal	System requirements	Content management systems
KnowledgeTree	System requirements	Document management systems

CHAPTER 4

SYSTEM DESIGNS

CHAPTER 4

SYSTEM DESIGNS

4.1 System Designs

Before the implementation phase of this open source knowledge management e-portal, there will be a system analysis and design phase.

System design is at the technical phase of the software engineering process and is used and referred during the software development life cycle (SDLC). A system design will also produce an architecture design, functionality design, data design and user interface design which will guide the implementation and development of the system.

Figure 9 (please refer to Appendix C) shows the 4 design phases for this knowledge management e-portal which are analysis phase, design phase, prototyping phase and development phase.

In analysis phase, end-users are involved in the early analysis phase with interview questions (please refer to Appendix A) before proceed to the design phase and lastly development phase. This is important to understand what the need of the end-users is and to get the end- user's opinion.

Besides that, in analysis phase, some of the existing websites using open source are analyzed and studied based on their context navigation, hierarchy and content layout. The information gathered is useful as reference in the interface design and content design of the knowledge management e-portal.

There are two groups of users who may use this knowledge management e-portal. These two groups of users are the systems administrators for the e-portal and the normal e-portal members which are the employees and visitors. The administrators will have full control to post forum, blogs and give access rights to normal user.

4.2 System Frameworks

System framework shows the "overall structure of the software and the ways in which that structure provides conceptual integrity for a system", Pressman (1997). Generally, system architecture is all the hierarchical structure of a program components and the way in which these components react and interact with each other.

This system framework also described the data used by the components in that particular program and the "components" in other words can be described as the system elements that form the program structure.

Figure 10 (please refer to Appendix C) shows the general framework design for this open source knowledge management e-portal.

This general framework for this e-portal consists of two major parts which are programming languages and applications. Programming languages that are used to build

this e-portal are HTML, Java and PHP while the applications tools which build the e-portal using those programming languages are KnowledgeTree, Drupal and Apache.

There is also database with SQL programming for the knowledge management e-portal. Figure 11 (please refer to Appendix C) shows the basic architecture design of this open source knowledge management e-portal.

In Figure 11 (please refer to Appendix C), whenever a user does anything with the knowledge management e-Portal, below is what happens.

- The relevant information is bundled off to the server in the form of an HTTP (HyperText Transfer Protocol) request. An HTTP request comes in two forms—either a GET or a POST.
- The server receives the HTTP request and the PHP page then gets processed and executed appropriately, and any actions that are required as a result of the user's request are performed.
- Once that is done, an appropriate response is returned by the server to the user's browser, and the cycle continues.

4.3 System Functionality Designs

Functionality design deals with the purpose and collaboration of each module to achieve the overall system functionality specifications.

4.3.1 Data Structure Diagrams

Data structure diagram is useful as a graphical representation of the structure of one or more of a system‘s data items or in another words, it is a graphical means of representing the composition of data. The data structure chart for this knowledge management e-portal is shown in Figure 12 (please refer to Appendix C).

In Figure 12 (please refer to Appendix C), the knowledge Management e-Portal is build from drupal and KnowledgeTree. Drupal is a php-based content management system while KnowledgeTree is a php-based document management system. The Drupal’s data object can be further divided into sub-data objects as shown in Figure 13 (please refer to Appendix C).

In Figure 13 (please refer to Appendix C), drupal can be divided into many modules which have its own functions. Some of them are as below.

- Forum: Allows the site to have threaded discussions about certain topics.
- Polls: Allows the site to capture votes on different topics in the form of multiple choice questions.
- Page: Allows user to add static page, like a contact page or an about page.
- Story: Stories are articles in their simplest form; they have title, a teaser and body. Stories may be used as a personal blog or for news articles.
- Themes: Allow users to change theme on the site.
- Blogs: Enables keeping easily and regularly updated user web pages or blogs.

Besides Drupal, KnowledgeTree can be also further divided into dashboard, document brower and dms administration as shown in Figure 14 (please refer to Appendix C).

In Figure 14 (please refer to Appendix C), KnowledgeTree can be divided to some modules of its own for administrations as below.

- Dashboard: which allows user to have general metadata search, manage RSS feeds, mail server status and manage checked-out and checked-in documents.
- Document Browser: Allows user to add document, add and manage folder, bulk export and upload permission settings.
- DMS administration: Allows administrator to set security to users or group for accessing document management. Also allow administrator to configure document metadata, document types, document fieldsets, link types and workflows.

4.3.2 Process Flow Diagrams

In this dissertation, open source drupal is used to build the knowledge management e-portal for managing organization or departmental knowledge. A process flow diagram will show the relationships between the major components in the knowledge management e-portal system. Drupal consists of page, node and menu in its building block. Figure 15 (please refer to Appendix C) shows the process flow diagram when the open source drupal is servicing a page.

Content types in drupal are derived from a single base type referred to as a node. Module developers can add features for nodes in general without worrying about the node's type. Nodes also contain a base set of behavioral properties that all other content types inherit. Figure 16 (please refer to Appendix C) shows the general process flow diagram when drupal is building a node.

Meanwhile Figure 17 (please refer to Appendix C) shows the process flow diagram when the drupal is building a menu for the knowledge management e-portal.

4.3.3 User Interface Designs

In this open source knowledge management e-portal, interfaces are designed in a user-friendly ways. Some of the criteria that were taken into consideration before designing this are general interaction, content, information display, data entry, navigation and hierarchy .

Below are some of the guidelines used in the interface design for the open source knowledge management e-portal.

- Deactivate commands that are inappropriate in the context of current actions. This protects the user from attempting some action that could result in an error.
- Be consistent. Use a consistent format for menu selection, navigation, command input, data hierarchy display and other myriad functions.
- Maintain consistency between information display and data input. The visual characteristics of the display (e.g. text size, color and placement) should be carried over the input domain.

CHAPTER 5

SYSTEM IMPLEMENTATIONS

CHAPTER 5

SYSTEM IMPLEMENTATIONS

5.1 Open Source Applications

5.1.1 PHP Programming Language

PHP (PHP: Hypertext Preprocessor) was written as a set of CGI binaries in the C programming language by the Danish Canadian programmer Rasmus Lerdorf in 1994, to replace a small set of Perl scripts he had been using to maintain his personal homepage.

But now, it has become open source and a reflective programming language design as a high level scripting language for producing dynamic web pages. At the moment this dissertation is written, the latest version of PHP is PHP5 after the released of PHP3 in 1999 (http://www.zend.com) and PHP4 in May 2000.

5.1.2 Drupal

Drupal is a highly modular, open source content management system (http://www.drupal.com). It was originally written by Dries Buytaert as a bulletin board system but formally released as an open source project in 2001. Actually, drupal is an

English translation of the Dutch word “druppel” which means “drop” as in water droplet.

Drupal is extensible, stands-compliant and released with basic core functionality where additional functionality is gained by the installation of modules. It is designed to be customized but customization is done by overriding the core or by adding modules, not by modifying the code in the core. Figure 18 (please refer to Appendix C) shows the drupal’s technology stack.

In Figure 18 (please refer to Appendix C), the operating system is at such a low level in the stack and has little effects on the drupal. It runs successfully on any operating system that supports PHP. The web server most widely used with drupal is apache though other web servers such as Microsoft IIS may be used.

Drupal interfaces with the next layer of the stack (the database) through a lightweight database abstraction layer. This layer handles sanitation of SQL queries and makes it possible to use different vendor’s databases without changing the code. It supports databases such as MySQL and PostgreSQL. Drupal is written entirely in PHP programming language. Figure 19 (please refer to Appendix C) shows the screenshot of the open source knowledge management e-portal from drupal.

A drupal’s block is small, self contained unit of information typically displayed in navigation area of the page, but can it can be placed anywhere on the page. Figure 20 (please refer to Appendix C) shows the screenshot of blocks menu in the knowledge management e-portal.

In Figure 20 (please refer to Appendix C), it shows that the block can be enabled or disabled in a specific location in the knowledge management e-portal.

5.1.2.1 Creating Blogs in Drupal

A blog is an abridgment of the term web log and usually maintained by individual or group of people. Some blogs focus on a particular subject such as fashion blogs, travel blogs, project blogs, niche blogs, classical music blogs, political blogs, education blogs and corporate blogs.

Corporate blogs is used internally to enhance the communication between the employees and knowledge sharing in an organization or department. Drupal allows the creation of blogs for knowledge management as shown by the screenshots in Figure 21 to Figure 26 (please refer to Appendix C).

First the user needs to login the open source knowledge management e-portal with the valid username and password. Click the “Create Content” link on the left panel and a new page will appear. Click on the “Blog entry” link to create a new blog and key in the necessary information. When this is done, click the submit button to post the blog on the e-portal.

5.1.2.2 Creating Forums in Drupal

Forum is useful for creating topic of discussions among the employees in the organization or department. Discussions on certain topics enable the capture of

knowledge and share the knowledge among the employees. Figure 27 to Figure 31 (please refer to Appendix C) show the screenshot of creating a forum in drupal.

After login, click on the “Create content” link and a new page with will appear. Click on the “Forum topic” to create a new forum and fill in all the necessary information before the submit button.

5.1.3 MySQL and phpMyAdmin

This knowledge management e-portal is using MySQL database (http://www.mysql.com). It is distributed free under ‘GNU General Public License’ where distribution and modification are allowed for anyone without prejudice. This MySQL is integrated in WAMP5 and Figure 32 (please refer to Appendix C) shows the screenshot on how to stop or start the MySQL services.

Besides that, phpMyadmin is used for managing the MySQL database. Figure 33 and Figure 34 (please refer to Appendix C) show the screenshot for phpMyAdmin and some of the tables available in the MySQL database.

5.1.4 Apache Web Server

This dissertation will use one of the most popular open source web-server which is apache web server (http://www.apache.org). Apache web server is considered as more efficient and stable than other web servers available on the internet.

Apache web server started from the Apache Software Foundation where communities around the world can add enhancements, bug-fixes and other supports for Apache. Figure 35 (please refer to Appendix C) shows the screenshot on how to start and stop the apache services.

5.1.5 KnowledgeTree

This dissertation will include knowledgetree which is an open source web based document management system into drupal for knowledge management, retention and knowledge sharing. Knowledgetree enable the organization or department to retain and share the knowledge.

"KnowldgeTree is phenomenal and incredibly simple. It's really, really cool and all web based. It took about two hours to set up and roll it out to all company departments", Maguire (2006).

This knowledgetree is accessible from existing tools such as web browsers, office productivity applications and email applications such as Microsoft Word, Excel, Outlook and the Windows Explorer. Figure 36 (please refer to Appendix C) shows the screenshot to access the KnowledgeTree in drupal. After clicked the "Knowledge Management" link and the knowledgeTree page will appear.

There are 3 main area of navigation in KnowledgeTree which is dashboard, browse documents and DMS administration. Figure 37 (please refer to Appendix C) shows the screenshot for the KnowledgeTree's dashboard once the user login with valid username and password.

Figure 38 (please refer to Appendix C) shows the page when the user click on the browse documents. It shows that a file name “Executive Leadership.pdf” is kept inside the MySQL database with the information such as title, the creator for this file and the date and time it was created.

5.1.5.1 Add Document in KnowledgeTree

Figure 39 to Figure 49 (please refer to Appendix C) show the screenshot on how to add a document or file in knowledgetree. First the user needs to click on the “add document” link on the left panel and then click on the browse button to add the document. After specifying the correct path, title and document type for the document, click the save button.

A message indicate that the document is successfully uploaded will appear and the user will need to fill in the metadata. The metadata are tag words, document’s author, the category of the document and the media type. The media type refers to the document type such as audio, image, text or video.

Once this is done, the document will be added to the MySQL database with the information for the document. The information added to the database will help the user in knowledge searching, knowledge sharing and knowledge retaining in the organization or department.

5.1.5.2 Download Document in KnowledgeTree

Figure 48 to Figure 50 (please refer to Appendix C) show the screenshot of downloading document in knowledgetree. First the user needs to click on the "download" link on the left panel and a pop-up message box will appear.

The user must click on the save button to save the desired document and select the location path for the document to be saved. After this is done, the user can check or open the document at the location where the document is downloaded just now.

Besides that, the user can also click on the icon as shown in Figure 51 to Figure 53 (please refer to Appendix C) to download the document. Message box will pop-up asking the user to save the document and to select the location path where the document needs to be saved. After this is done, the user can check or open the document at the location where this document is downloaded just now.

5.1.5.3 Delete Document in KnowledgeTree

Figure 54 to Figure 58 (please refer to Appendix C) show the screenshot of deleting document in KnowledgeTree. First the user needs to select the desired document to delete by clicking on the text box. After that, click on the delete button and a message asking for confirmation for deletion will appear.

Click the continue button to proceed on the deletion and finally the user will notice that the document is deleted from the MySQL database where it is not shown in the KnowledgeTree's document browser anymore.

5.1.5.4 Add Folder in KnowledgeTree

Figure 59 to Figure 61 (please refer to Appendix C) show the screenshot of adding folder in knowledgetree. The folder is important for managing the knowledge and easier for knowledge searching by the user. First the user needs to click on the "add a folder" link on the left panel and a new page will appear.

Give a suitable name for the new folder and click the add folder button. When the folder is successfully added, the user will see the new folder appeared on the knowledgetree's document browser.

5.1.5.5 Allocate Roles in KnowledgeTree

The allocation of roles is important for managing and sharing the knowledge. The roles such as manager, interviewer, researcher, journalist and etc assign to certain folders or documents will determine how the knowledge can be managed. Figure 62 to Figure 66 (please refer to Appendix C) show the screenshot of allocating roles in KnowledgeTree.

First the user needs to click on the "allocate roles" link on the left panel and a new page will appear. Select the desired user and click the right arrow button to add the user. Once this is done, the user can see a message of "allocation changed" on the page.

5.1.5.6 Permission for Folder in KnowledgeTree

Figure 67 to Figure 76 (please refer to Appendix C) show the screenshot of allocating permission for folder in KnowledgeTree. The allocation of permission for the folder is important for managing the knowledge by controlling the access to the document.

First the user needs to click on the “permissions” link on the left panel and a new page for editing permission will appear. Click on the “edit permissions” link and select the permission desired for the user by clicking on the icon.

The available permissions for selection are read, write, add folder, manage security, delete, manage workflow, folder details and rename folder. If the “write” permission is unclicked as in Figure 70 (please refer to Appendix C) and proceeds with the update permission assignment’s button, message “permissions on folder updated” will appear when this is done.

The user will also notice that the colour for the icon under write permission is changed into red from green. Figure 74 to Figure 76 (please refer to Appendix C) show the screenshot of allocating back the write permission.

5.1.5.7 Search Functions in KnowledgeTree

Managing organization or departmental knowledge through an e-portal will need a search function. A good searching function will cut down the time when a user is looking for document or knowledge in the database. Figure 77 to Figure 89 (please refer to Appendix C) show the screenshot of search function in knowledgetree.

First the user needs to click on the “search” link on the left panel and a text box with search button will appear. Key in the search item in the text box and click the search button. The reach result will appear afterwards.

If the customer key in a search name for document that is not kept in the MySQL database, a message result “no documents or folders match the query” will appear as the screenshot in Figure 81 (please refer to Appendix C).

Figure 82 to Figure 83 (please refer to Appendix C), show the screenshot of user getting help by clicking on the “How do I search?” link and a page with the help instructions will appear to guide the user.

Besides that, the user can use the advanced search function by clicking on the “Advanced search” link and fill in all the necessary search criteria to get the advanced search as in screenshot of Figure 84 to Figure 89 (please refer to Appendix C).

5.1.5.8 Folder Transactions in KnowledgeTree

Figure 90 to Figure 91 (please refer to Appendix C) show the screenshot for folder transactions in KnowledgeTree. This enables the user to see the transactions log of the folder which will help in managing the knowledge.

First the user needs to click on the “Folder transactions” link on the left panel and a new page with the folder transactions history will appear.

5.1.5.9 Users and Groups Management in KnowledgeTree

Figure 92 to Figure 103 (please refer to Appendix C) show the screenshot for the users and groups management in KnowledgeTree. Managing the users and groups will help in managing the knowledge in the organization or department.

The user needs to click on the “DMS Administration” link on the panel and a new page with “Users and Groups” link will appear. Click on the “Users and Groups” link and then click the “Manage Users” link and a new page will appear.

Click on the add user button and fill in all the necessary information such as name, username, password, email address, mobile number and etc to add a new user. When this is done, a message indicating that the new user is created will appear.

Figure 99 to Figure 103 (please refer to Appendix C) show the screenshot to add a user to a group and when this is finished, a message will show that the user is updated.

5.1.5.10 Document Storage Management in KnowledgeTree

Figure 104 to Figure 107 (please refer to Appendix C) show the screenshot for document storage management in KnowledgeTree. This function allows the user to verify the storage condition in the database.

First click on the “Document Storage” link and then click the “Manage Users” link and a new page will appear. After that click the Verify Document Storage button and the process of checking the storage will be activated. A message “No problem found-

database is consistent with the contents of the repository" will appear after the verification found no problem with the storage.

CHAPTER 6

SYSTEM EVALUATIONS

CHAPTER 6

SYSTEM EVALUATIONS

6.0 Evaluations

Empirical research is used in the research methodology for this dissertation to know whether the open source knowledge management e-portal can meet the requirements of knowledge retention and knowledge management in the organization or department.

Empirical research is any research that based its findings on direct or indirect observation as its test of reality. This dissertation has chosen the employees working in NTTMSC Sdn Bhd's Data Centre as the testing subjects for this research and data are gathered from these employees through interviews forms and questionnaire forms after their period of interaction with the open source knowledge management e-portal expired.

The reason why NTTMSC Sdn Bhd is chosen as the test bed is because the employees in the company have given the green light to participate in the testing.

6.1 Details of Samples

Table 2 below shows the background information or the profiles of the targeted employees that take part in this research. The profile or information gathered will

include their name, age, designation, department and years of working experiences in the information technology industry.

Information such as gender, culture and race of the employees are excluded in this research table because they are not relevant to be taken into consideration. The sampling size for this research is 10 persons and the time frame is 3 months.

The participants will be given an interview forms (refer to appendix A) earlier before they take part on the testing and after the 3 months period, the targeted users will be given an evaluations form (refer to appendix B) for them to fill-up. The data gathered will be used for analysis to determine whether the open source knowledge management e-portal has meets its objectives described in the literature review.

Table 2: Profiles of the Participants

Name	**Age**	**Designation**	**Department**	**Working experience (Years)**
Ch'ng Cheok Ho (CCH)	28	Noc Engineer	Data Centre	8
Yazid Majid (YM)	24	Noc Engineer	Data Centre	2
Saiful Rizan (SR)	29	Noc Engineer	Data Centre	8
Leang Wai Loon (LWL)	24	Noc Engineer	Data Centre	2
Shamsul Nizam (SN)	26	Noc Engineer	Data Centre	4
Almalix Kosni (AK)	28	Noc Engineer	Data Centre	6
Nelson Gan (NG)	28	Noc Engineer	Data Centre	8
Shamsul Husni (SH)	31	Noc Engineer	Data Centre	9
Mohd Anafin (MA)	24	Noc Engineer	Data Centre	2
Kenneth Edmund (KE)	31	Noc Engineer	Data Centre	6

6.2 Sampling Techniques

In the evaluations forms distributed to the participants, there are columns for them to rank or give "points" according to the questions in the forms. The points will be the raw data for statistical analysis of whether the open source knowledge management e-portal meets the objectives.

The participants can choose between "very good", "good", "medium", "poor" or "very poor" in their answers and each of them carry a certain points accordingly. Table 3 shows the points allocation for the answers given.

Table 3: Points Allocation for Answers

Descriptions	**Points Allocation**
Very Poor	1
Poor	2
Medium	3
Good	4
Very Good	5

The points given by the participants in the evaluations form reflect their closest possible answer to the questions after testing the systems within the testing period.

6.3 Statistical Analysis and Evaluations

The data gathered from the evaluations forms submitted by the participants are shown in table 4 while table 5 shows the compiled data. In table 4, it is divided into part 1, 2 and 3 according to the evaluations form.

Table 4: Data Collected from the Evaluations Form

Questions\Name	**CCH**	**YM**	**SR**	**LWL**	**SN**	**AK**	**NG**	**SH**	**MA**	**KE**
Part 1 (No)\Ranking										
1	4	3	4	4	3	4	4	4	4	4
2	4	3	4	4	3	4	4	4	4	4
3	3	3	2	4	4	2	4	2	4	3
4	4	3	2	1	2	4	3	4	4	3
5	4	4	4	4	4	4	4	4	4	4
6	4	5	4	4	4	4	4	4	4	3
7	4	5	4	4	4	2	4	3	4	4
8	4	3	4	4	4	4	4	4	4	4
9	4	4	4	4	4	2	4	4	4	3
10	4	4	4	4	4	2	4	4	4	4
Part 2 (No)										
1	3	2	3	3	3	4	3	3	3	2
2	3	2	3	3	3	3	2	4	3	4
3	3	3	3	3	2	3	2	4	1	3
4	3	3	5	5	3	2	3	2	2	2
5	2	3	3	2	3	2	3	2	3	2
Part 3 (No)										
1	3	3	3	3	2	4	2	2	3	3
2	4	4	5	4	4	3	5	4	5	3

Table 5: The Compiled Data from the Evaluations Form.

Name	**Total Points for Part 1**	**Total Points for Part 2**	**Total Points for Part 3**	**Total Points for Part 1,2,and 3**
Ch'ng Cheok Ho	39	14	7	60
Yazid Majid	37	13	7	57
Saiful Rizan	36	17	8	61
Leang Wai Loon	37	16	7	60
Shamsul Nizam	36	14	6	56
Almalix Kosni	34	14	7	55
Nelson Gan	39	13	7	59
Shamsul Husni	35	15	6	56
Mohd Anafin	40	12	8	60
Kenneth Edmund	36	13	6	55
Total(overall)	369	141	69	**579**

Table 5 shows the total points given by each user according to the "parts" and also the overall points by each user. Meanwhile, Table 6 shows the total points according to categories or cases. The categories are derived from the assumptions if all the points are set to a certain value in part 1, 2 and 3 according to Table 3.

Table 6: Categories of Cases

Categories	**Total Points**
Very Poor Case (all points are 1)	170
Poor Case (all points are 2)	340
Medium Case (all points are 3)	510
Good Case (all points are 4)	680
Very Good Case (all points are 5)	850

Figure 108 below shows the pie chart of system features evaluations for part 1 derived from Table 4. The systems features get 75% vote of good features and 2% of them get a ratings of very good. Only 1% of the features get a very poor in the ratings. This clearly showed that the users are satisfied with the features in the systems.

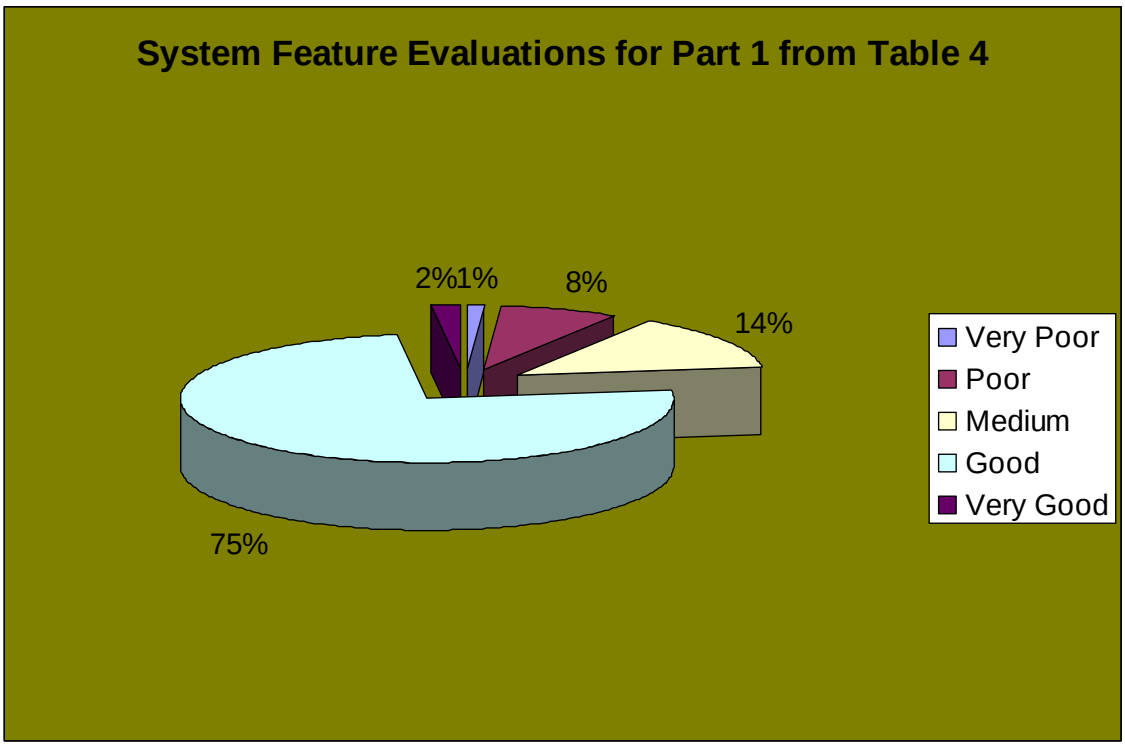

Figure 108: Pie Chart showing System Feature Evaluations for Part 1

Based on Table 4 also, Figure 109 and Figure 110 show the pie chart of the interface evaluations for part 2 and systems evaluations for part 3. Around 8% of the system interfaces get good ratings while 30% of them meet the very good ratings according to Figure 109. These shows that the systems interface meet the expectations of the users and considered a good system.

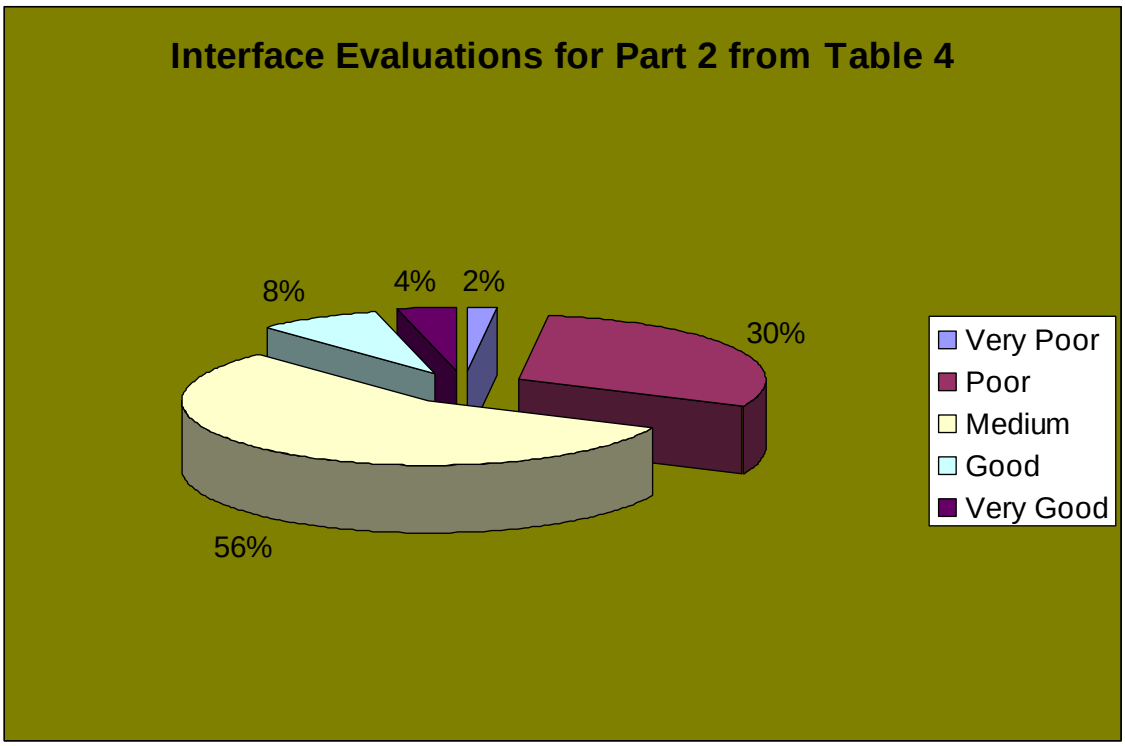

Figure 109: Pie Chart showing Interface Evaluations for Part 2

Besides that, in Figure 110 below, 15% of the overall systems meet the very good ratings from the respondents and 0% or none of them think that the overall systems is very poor.

Again, this proved that the overall systems of the knowledge management e-portal meet the requirements and expectations of managing the organization or departmental knowledge. Even though the overall systems did not achieved a major percentage of approval but it is still open for improvement and future enhancements.

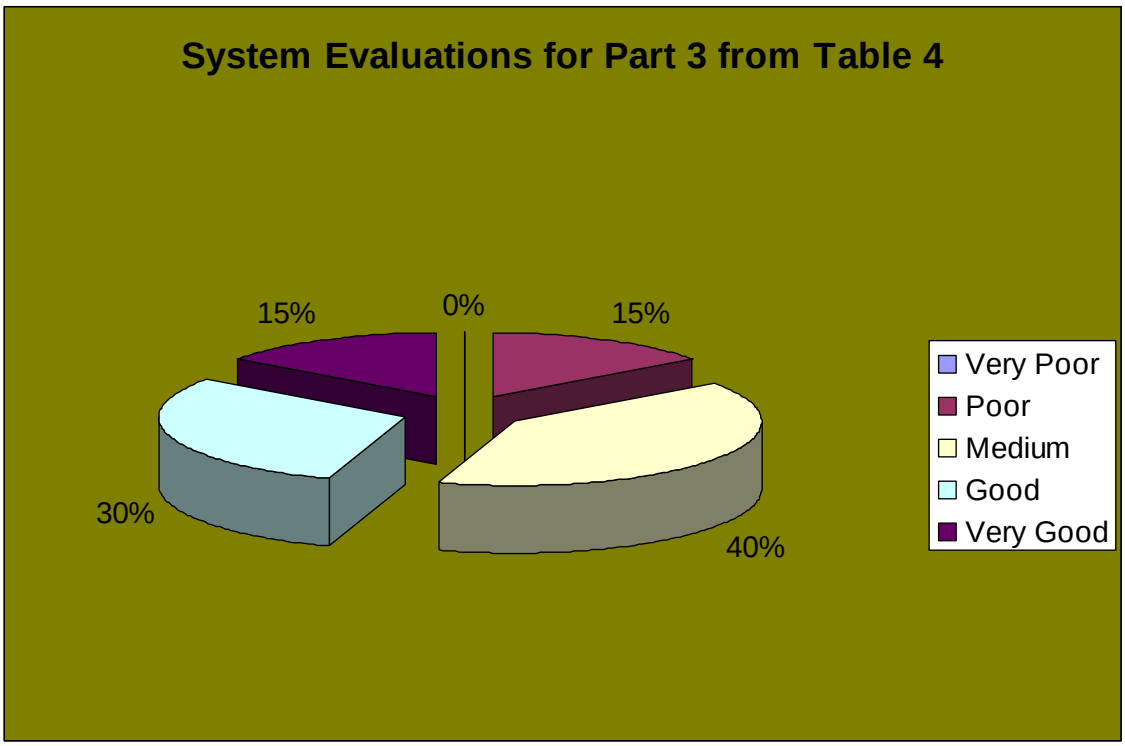

Figure 110: Pie Chart showing System Evaluations for Part 3

As for the Figure 111 below, it shows the comparison by categories or cases derived from Table 6. This comparison is based on the hypothesis that if any categories fall above certain categories, that categories must be better than the categories below it.

Therefore, from Figure 111, the evaluations result is above the medium categories and almost reach the good case categories. This again proved that the systems is above medium ratings and can be consider as a good systems for managing departmental or organization knowledge.

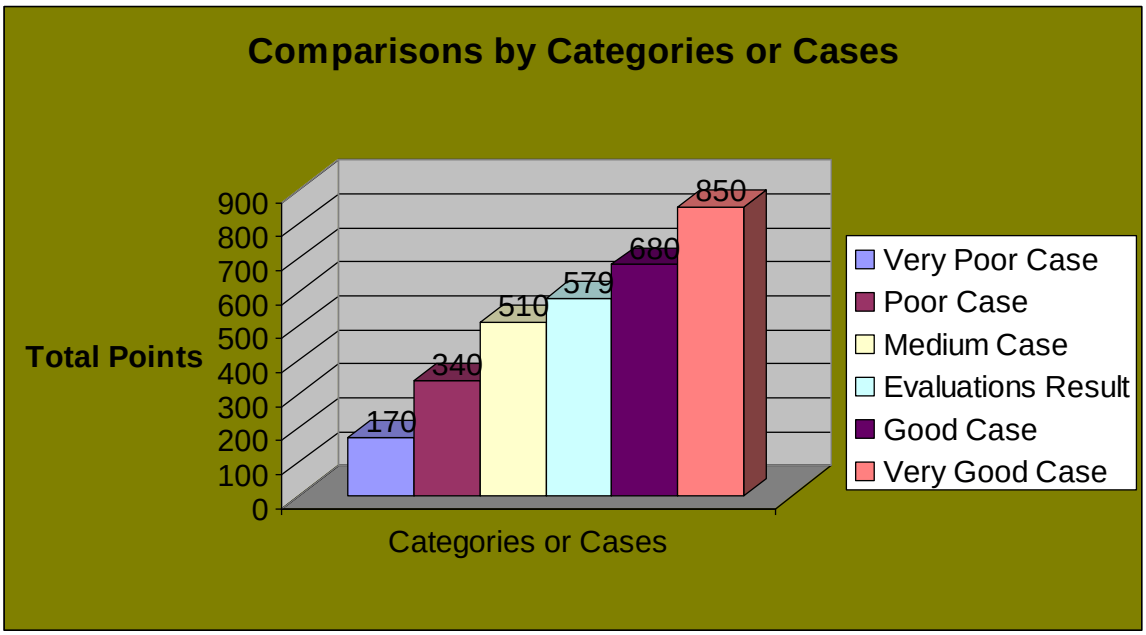

Figure 111: Bar Chart of Comparison by Categories or Cases.

All the results show that most of the testers are satisfied with the open source knowledge management e-portal in managing, retaining, sharing and capturing organization or departmental knowledge. Even though this open source knowledge management portal does have its weakness and limitations, this can be enhanced and fix in the future development. Chapter 7 will cover the users' suggestions and future enhancements for this system.

CHAPTER 7

SUMMARY AND CONCLUSION

CHAPTER 7

SUMMARY AND CONCLUSION

7.0 Achievements

During the implementation of this open source knowledge management e-portal, some of the achievements obtained can be categorized into theoretical knowledge and practical knowledge as below.

- Theoretical knowledge in knowledge management
- Practical knowledge in programming.

7.0.1 Theoretical Knowledge in Knowledge Management

This dissertation presents a substantial amount of information related to knowledge management, knowledge sharing, knowledge retention and how this mechanisms work. An in-depth overview is also given on how the open source, drupal's content management systems and KnowledgeTree's document management systems work.

7.0.2 Practical Knowledge in Programming

Practical programming experiences can be obtained throughout the implementation of this knowledge management e-portal. The eminent part of practical programming knowledge can be seen from the usage of PHP programming language to build-up the

modules and interfaces of e-portal. Valuable optimizations and stabilizations know-how have also been obtained from this project.

7.1 Advantages of Knowledge Management e-Portal

This knowledge management e-portal is developed as mean of managing and capturing knowledge from the work force before it is lost. Some of the few advantages are listed as below:

- Knowledge management e-portal has a simple design with easy way to set rules on the interfaces and modules for managing knowledge.
- Knowledge management e-portal used a friendly and easy navigation between interfaces and modules for knowledge retention.
- Open source knowledge management is free for any uses without extra cost.

7.2 System Limitations.

Due to time constraints, some of the knowledge management portal's weaknesses have been identified and listed as below:

- The open source knowledge management e-portal lacks a strong security features that could prevent hackers and intruders.
- The knowledge management e-portal lack analysis report tools to show the percentage of usage and utilization by the users.
- The knowledge management e-portal does not have the ability to update its portal automatically for patches.

7.3 Future Enhancements

This open source knowledge management e-portal provides some good opportunities for enhancements. Interested programmer or reader that wishes to contribute their effort on this knowledge management e-portal can consider building extra modules and functionalities as part of academic projects in the future. Among some constructive suggestions to further improve this knowledge management e-portal are as below:

- An automatic update of security patches which prevent the e-portal from intruders and hackers.
- Graphing or reporting tools for the knowledge management e-portal.
- Add extra functions and capabilities to the knowledge management e-portal such as video recording, online project management, news-portals, teleconferencing and online training.

7.4 Conclusion

This dissertation shows that open source knowledge management e-portal can be used as an alternative method to retain, share and manage organization or departmental knowledge.

Although the open source knowledge management e-portal has its own limitations but its design and layout can serve as a foundation for future enhancements. It is hoped that this dissertation will be beneficial as a basic reference guides for the departments or organizations that interested in managing their knowledge through the open source e-portal in the future.

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APPENDICES

APPENDIX A

INTERVIEWS FORM

Interviews Form

Name:	Date:
Age:	Department:
Designation:	Years of work experience:

This is the interviews form for the open source knowledge management e-portal. This will help the research of whether the proposed open source knowledge management e-portal can meet the objectives of knowledge management and knowledge retention in the organization or department.

Please give your answer for the questions.

1. Do you think that the retired employees or leaving workforce from the organization or department posed problems in term of knowledge loss?

2. Do you think organization or department should give emphasize on knowledge sharing among the employees and why?

3. Please identify the potential knowledge attritions in the organization or department that you are currently working.

4. Please suggest the ways for knowledge sharing and knowledge retention among the employees in your organization or department.

5. What are the necessary support structures and roles that the management can help to speed up the knowledge retention and sharing process in the organization or department?

6. Do you think that the current system (if there is any) implemented in your organization or department can meet the objectives of knowledge management and knowledge retention.

7. Please give your suggestions or recommendations of the available technologies that most suitable to implement a knowledge management system.

8. What are the most important features that you think should be made available in a knowledge management system.

9. Please give examples of any good knowledge management system that you had used before during your working days.

10. Do you think cost is an important factor to consider when choosing a knowledge management system and would you consider open source?

Thank you for your valuable time to fill up the interviews form.

APPENDIX B

EVALUATIONS FORM

Knowledge Management E-Portal Evaluations Form

Name:	Date:
Age:	Department:
Designation:	Years of work experience:

This form is to evaluate whether the knowledge management e-portal can meet the objective of knowledge management, knowledge sharing and retention in the organization or department.

Part 1: Systems features of the knowledge management e-portal

Please answer and rank the questions based on the scale provided

1=Very Poor 2=Poor 3=Medium 4=Good 5=Very Good

No	Features	Ranking	Remarks (if any)
1	User login function to authorize user access into the knowledge management e-portal.		
2	Navigation bar for moving around the pages in the knowledge management e-portal.		
3	The search-box for the searching purposes in the knowledge management e-portal		
4	Help-guides functions to help users when using the knowledge management e-portal.		
5	Creation and publishing of content functions via page and file management modules.		
6	The blog functions to post blog in the knowledge management e-portal.		
7	The forum functions to post forum in the knowledge management e-portal.		

8	Users and groups management functions in the knowledge management e-portal		
9	Documents management functions in KnowledgeTree of the knowledge management e-portal		
10	Content management in KnowledgeTree of the knowledge management e-portal.		

Part 2: Interface Evaluations of the knowledge management e-portal

Please answer and rank the questions based on the scale provided

1=Very Poor 2=Poor 3=Medium 4=Good 5=Very Good

No	Testing features	Ranking	Remarks (if any)
1	Background and text colour of the knowledge management e-portal.		
2	Hyperlink for navigation of the knowledge management e-portal.		
3	Arrangement of menu blocks of the knowledge management e-portal.		
4	Clarity of instruction and text in the knowledge management e-portal.		
5	Consistency of visual style in the knowledge management e-portal.		

Part 3: Overall systems of the knowledge management e-portal

Please answer and rank the questions based on the scale provided

1=Very Poor 2=Poor 3=Medium 4=Good 5=Very Good

1	The overall features and user interface in the knowledge management e-portal.		
2	The overall systems for retaining, sharing and managing organization or departmental knowledge through the knowledge management e-portal.		

Would you recommend this knowledge management e-portal to be used by other departments? Please give your reasons if the answer is yes.

Please give your suggestions or comments (if any) for future enhancement of the knowledge management e-portal

Thank you for your valuable time to fill up the evaluations form.

APPENDIX C

SCREENSHOT OF FIGURES

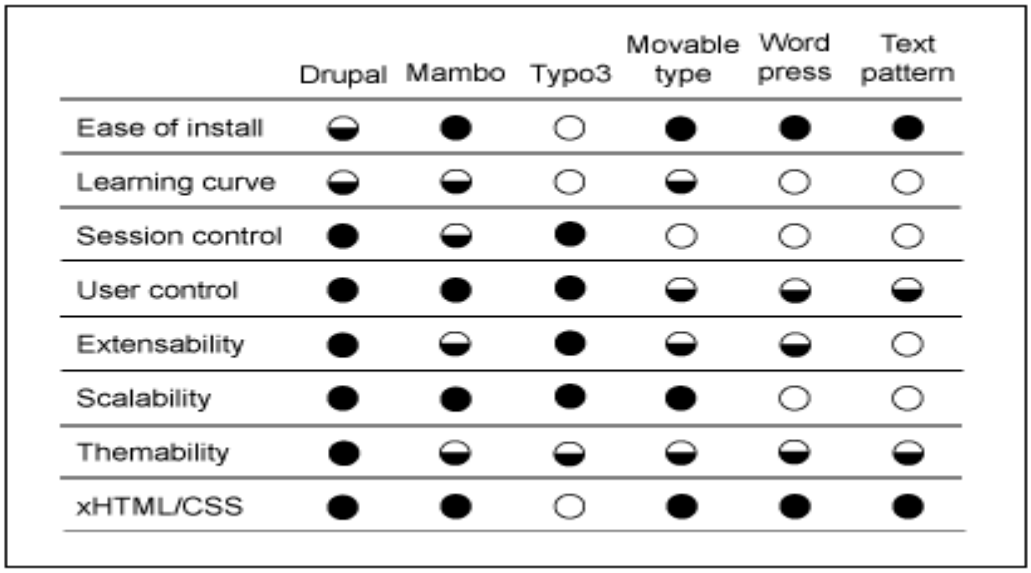

Figure 8: A Comparison of Content Management Systems

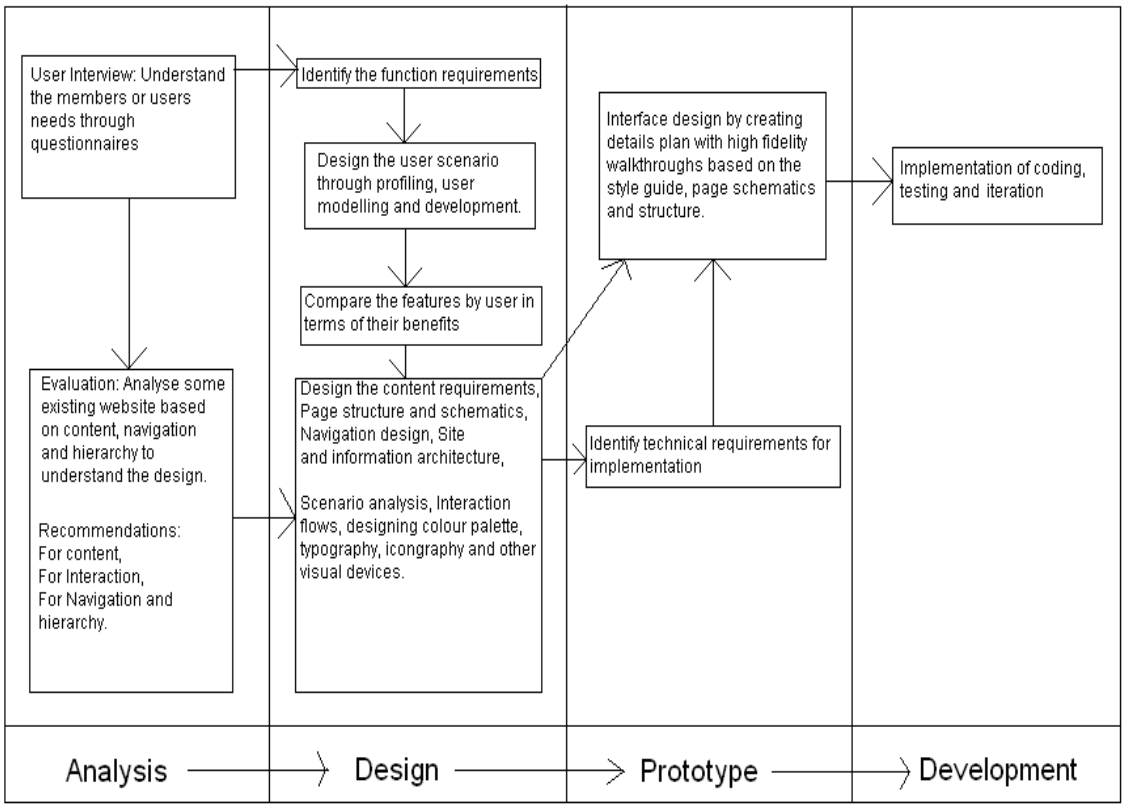

Figure 9: Phases of Design for the Knowledge Management e-Portal

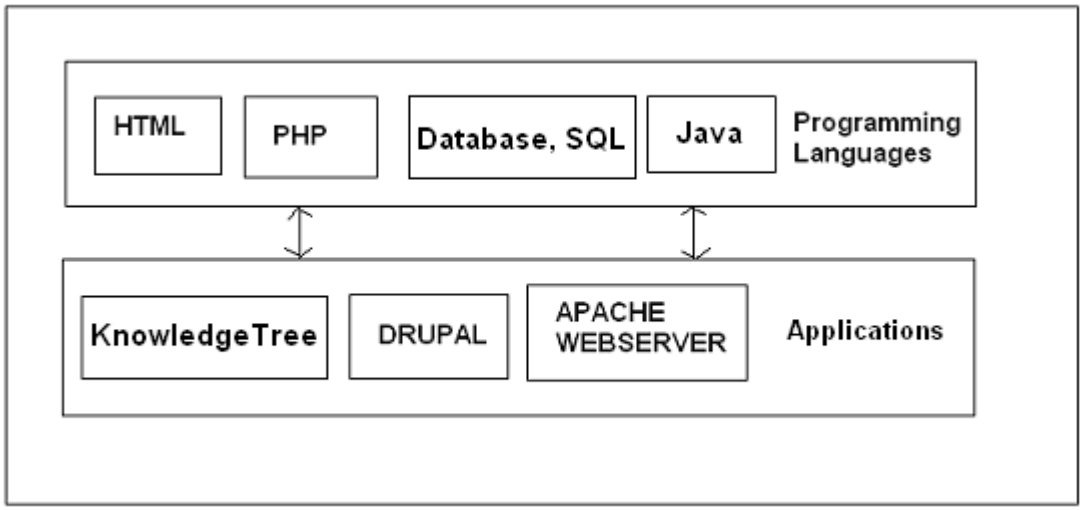

Figure 10: General Framework for the Knowledge Management e-Portal

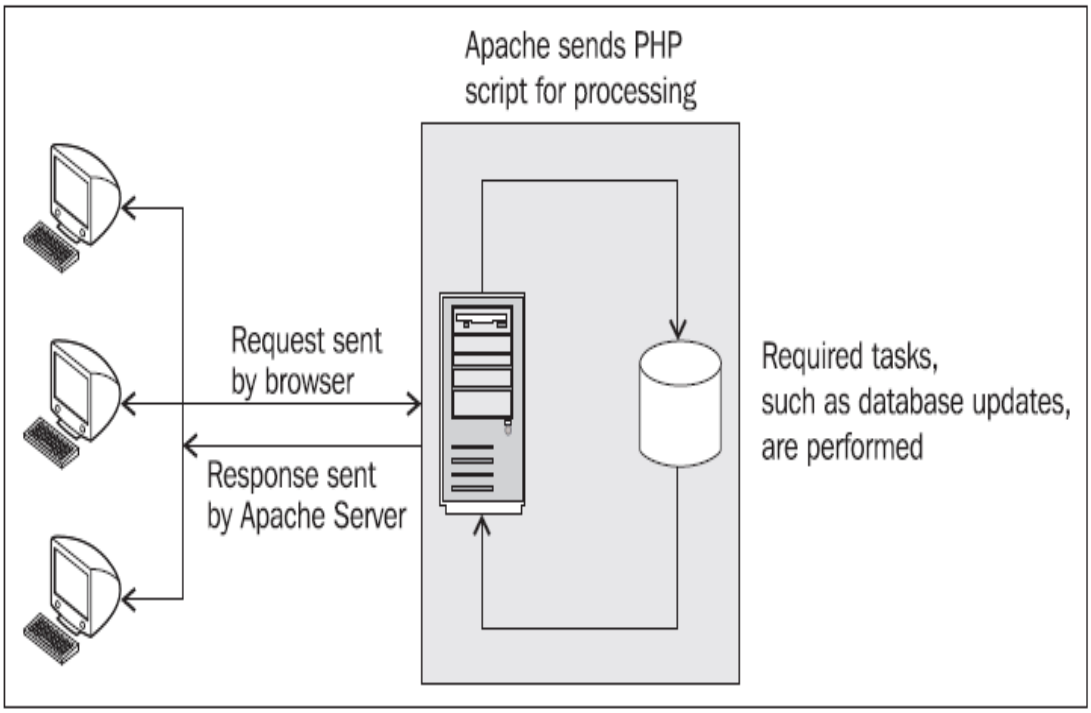

Figure 11: Basic Architecture Design for the Knowledge Management e-Portal

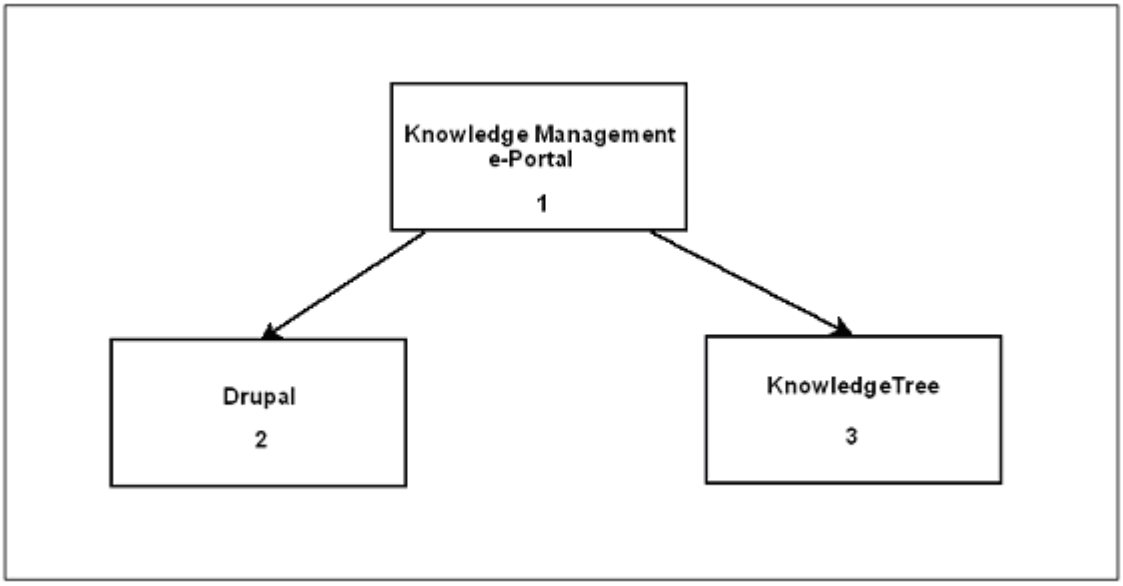

Figure 12: Structure Chart for Knowledge Management e-Portal

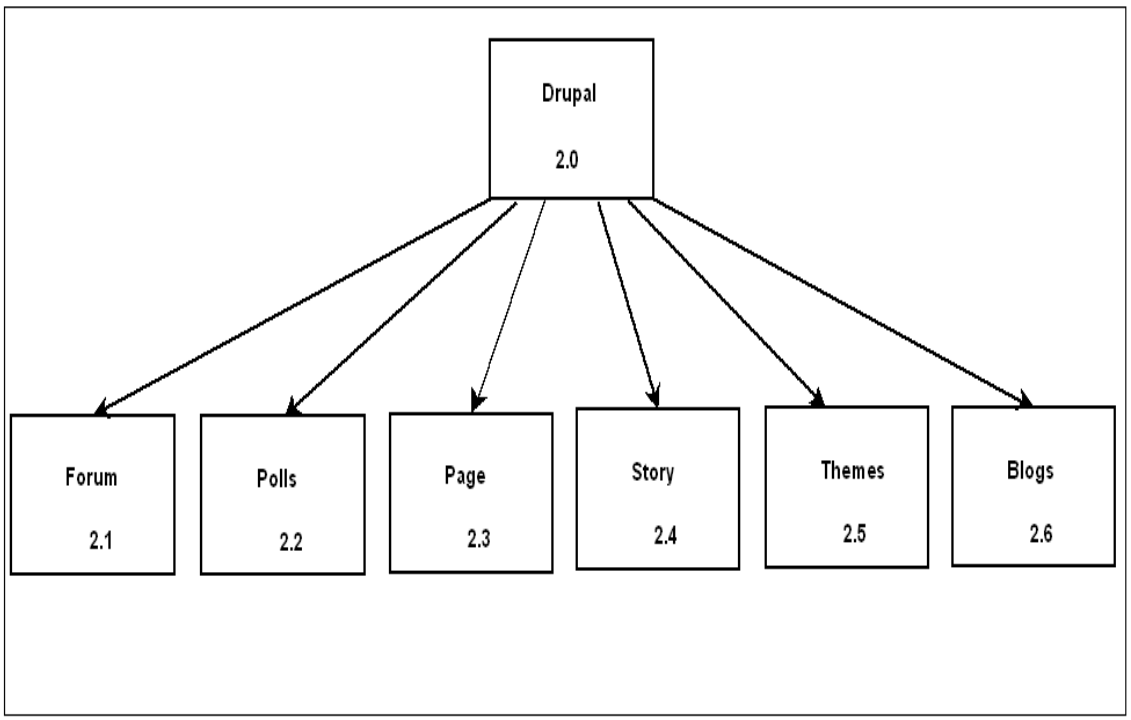

Figure 13: Structure Chart for Drupal

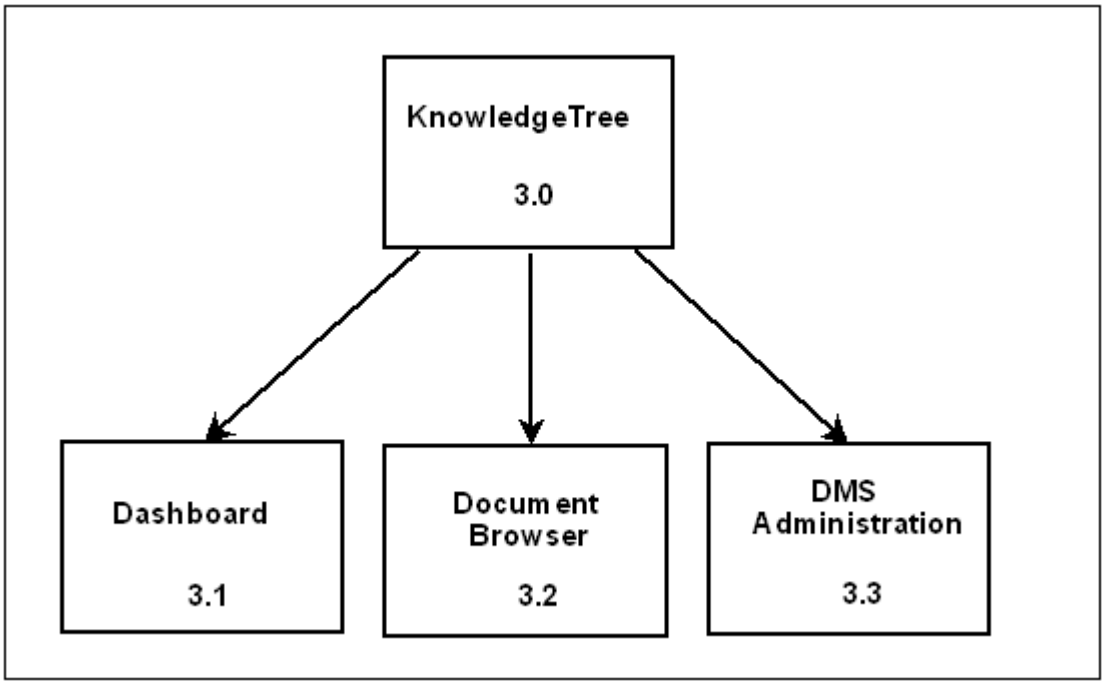

Figure 14: Structure Chart for KnowledgeTree

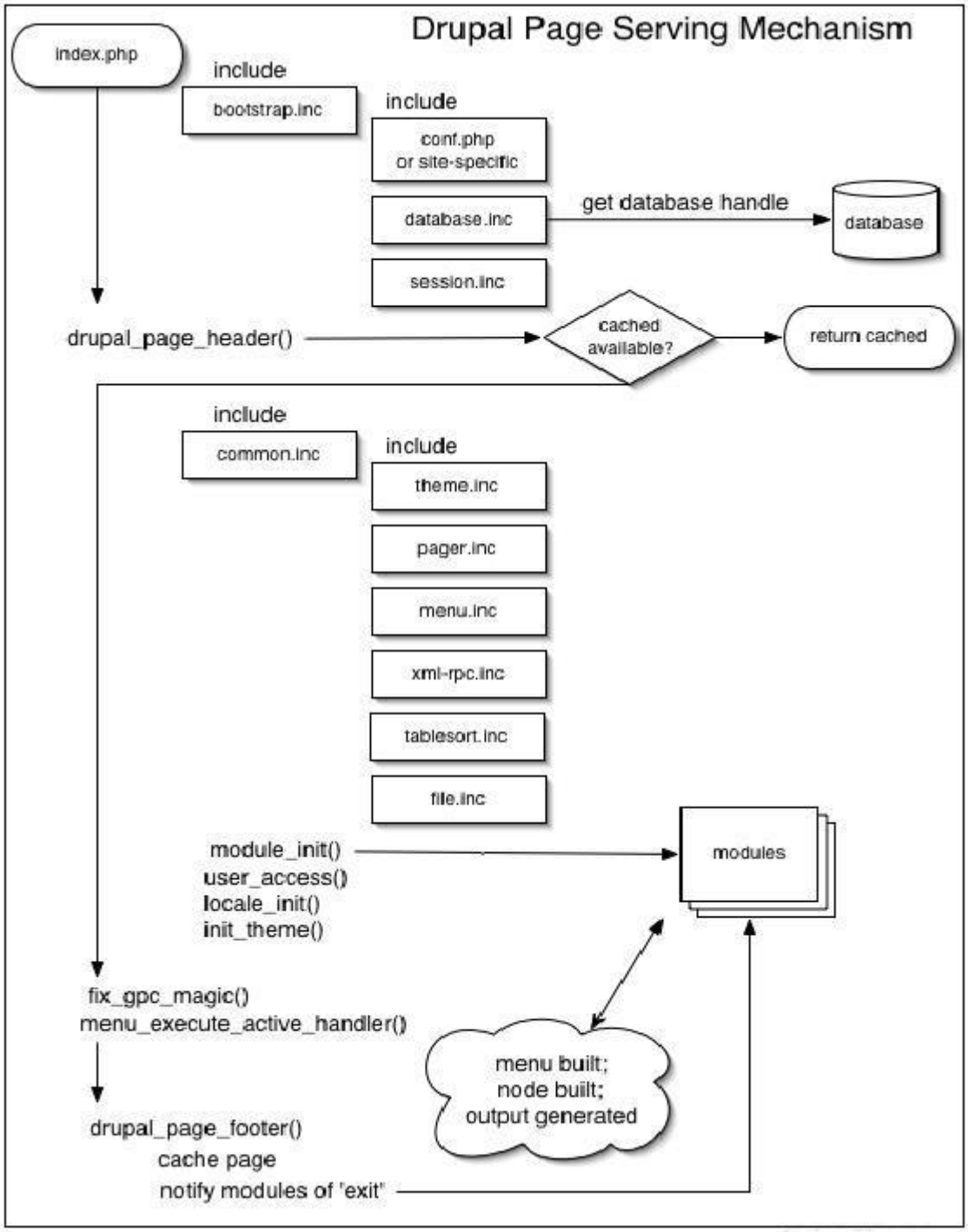

Figure 15: Process Flow Diagram When Drupal Is Servicing a Page

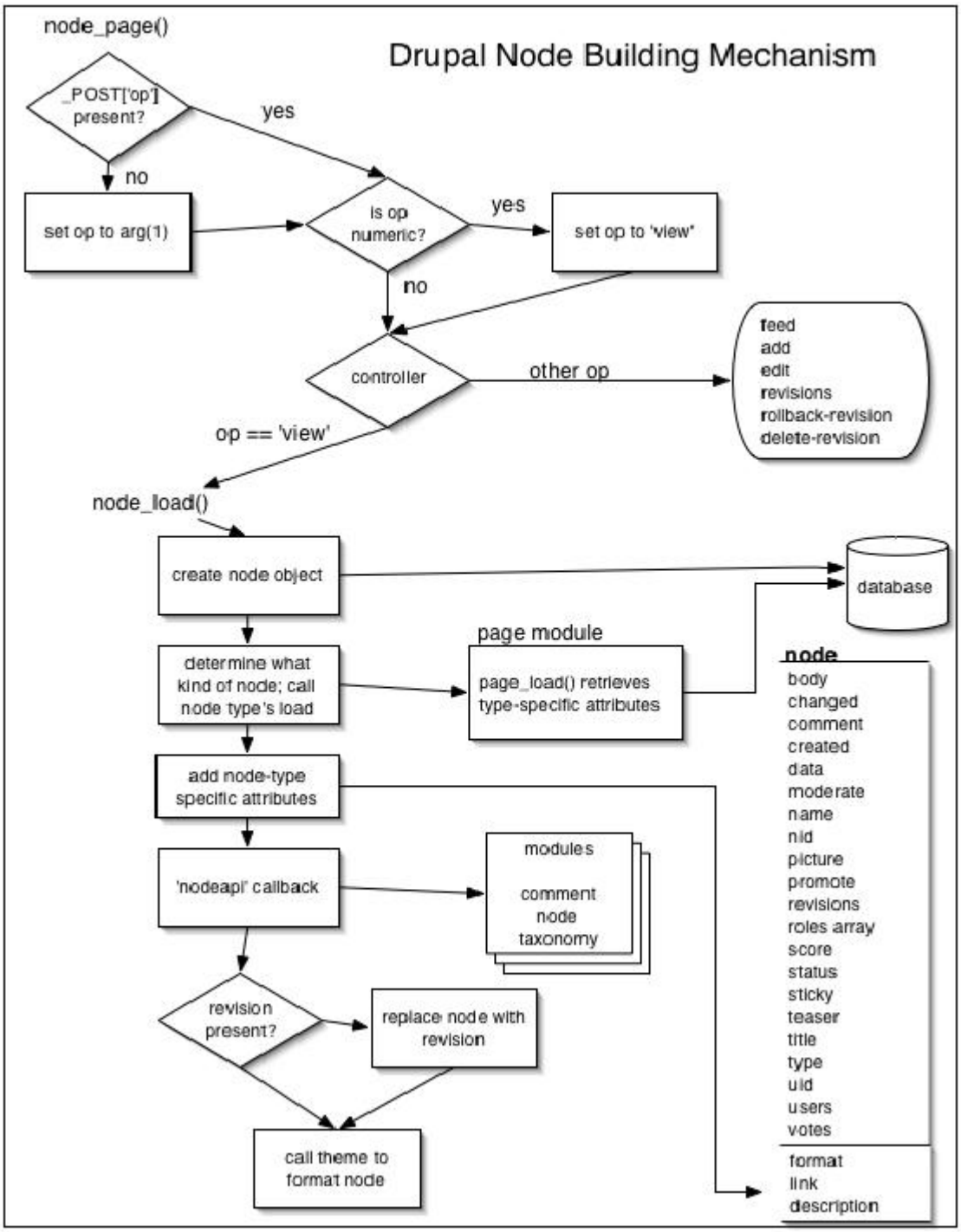

Figure 16: Process Flow Diagram When Drupal Is Building A Node

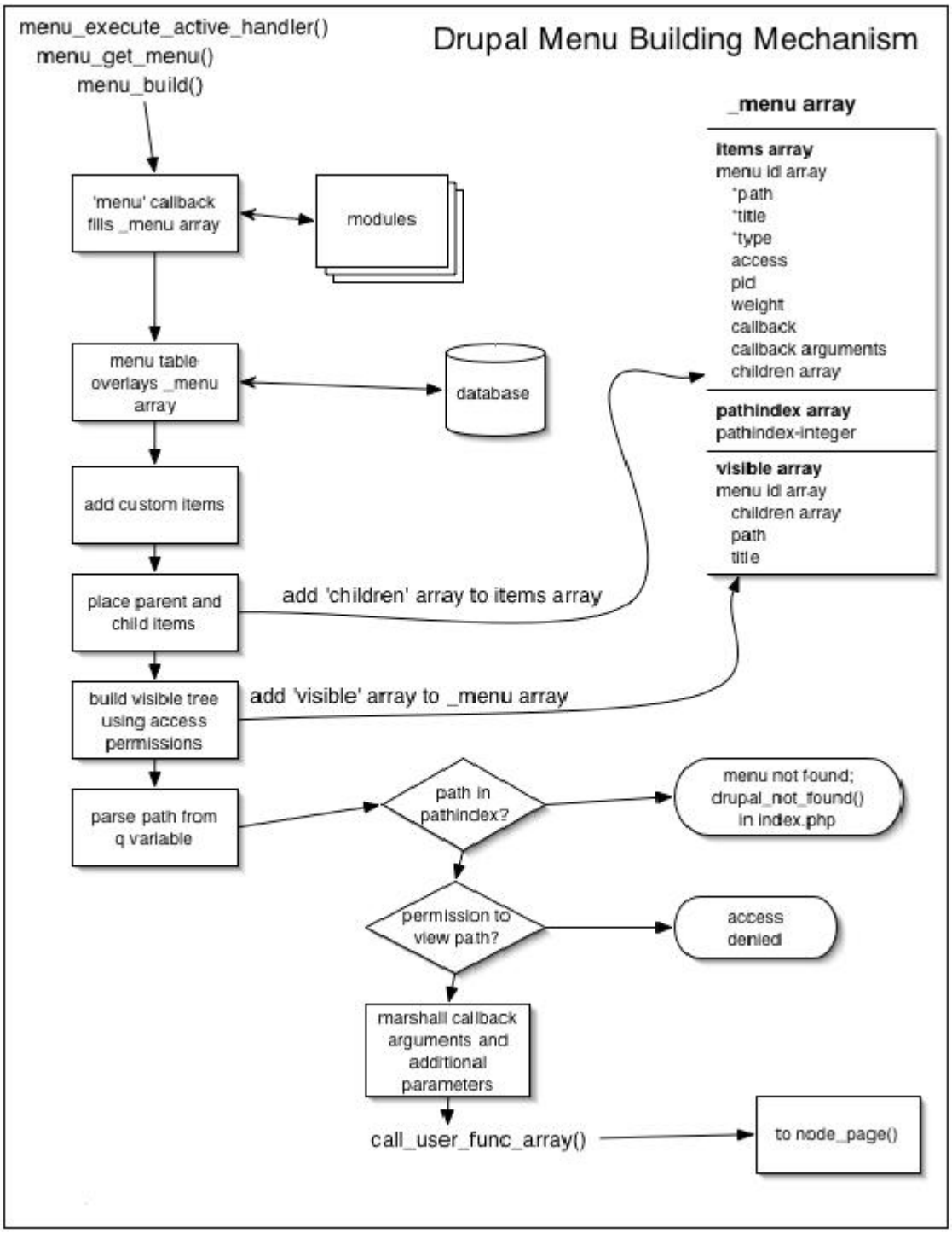

Figure 17: Process Flow Diagram When Drupal Is Building a Menu

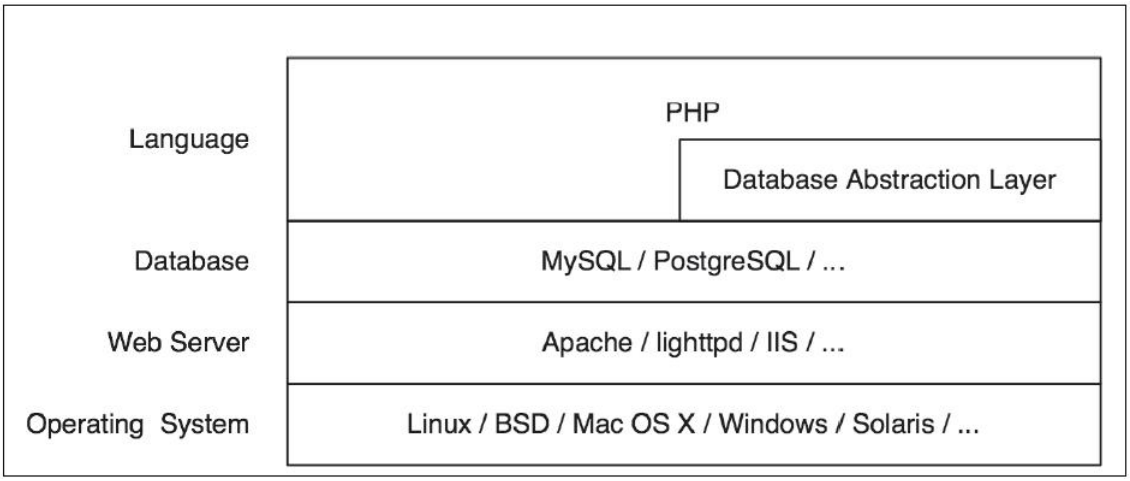

Figure 18: Drupal's Technology Stack

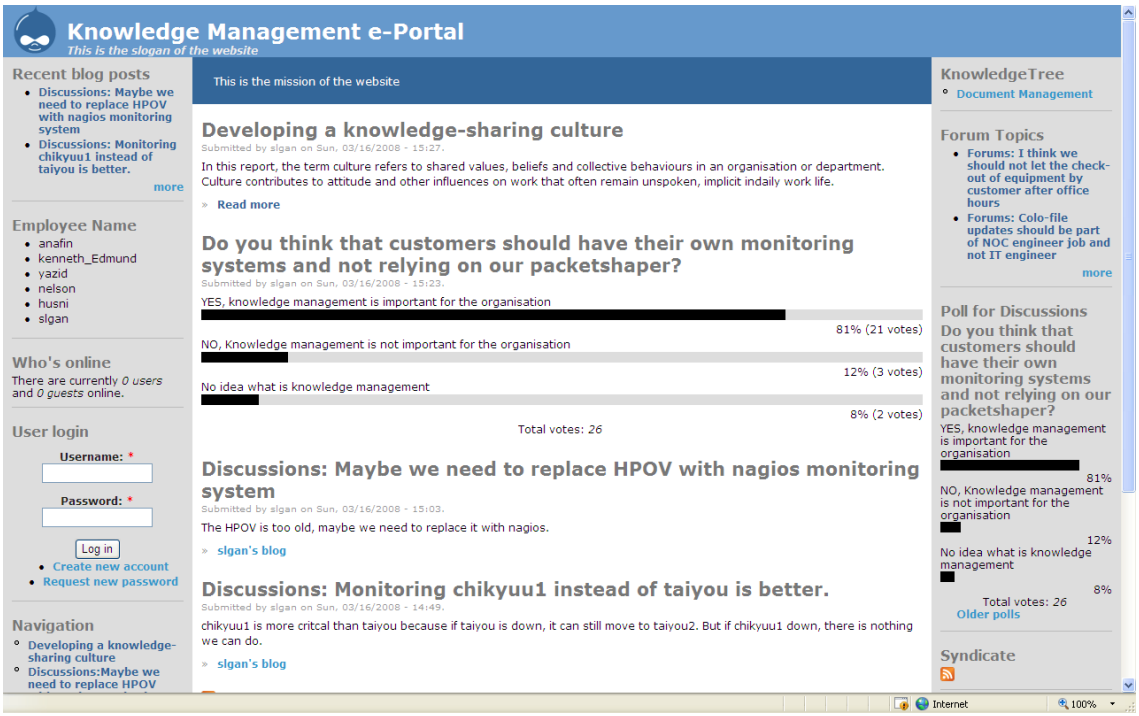

Figure 19: Screenshot of Knowledge Management e-Portal

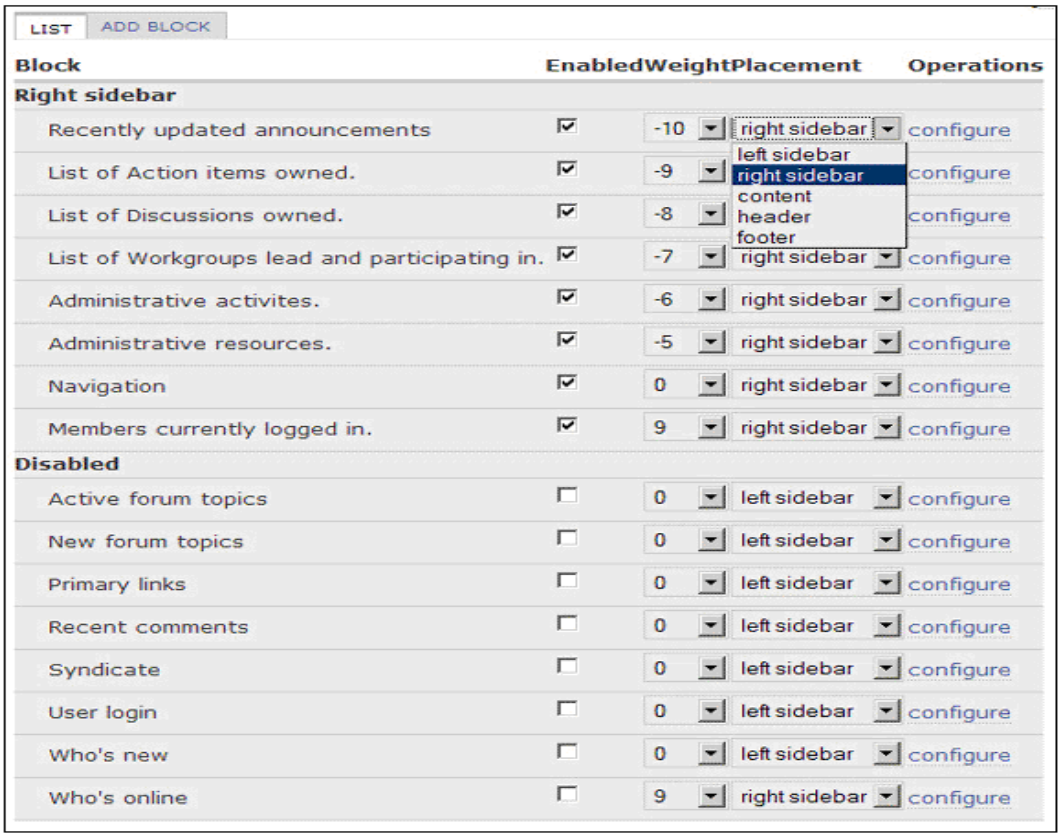

Figure 20: Screenshot of Blocks in the Knowledge Management e-Portal

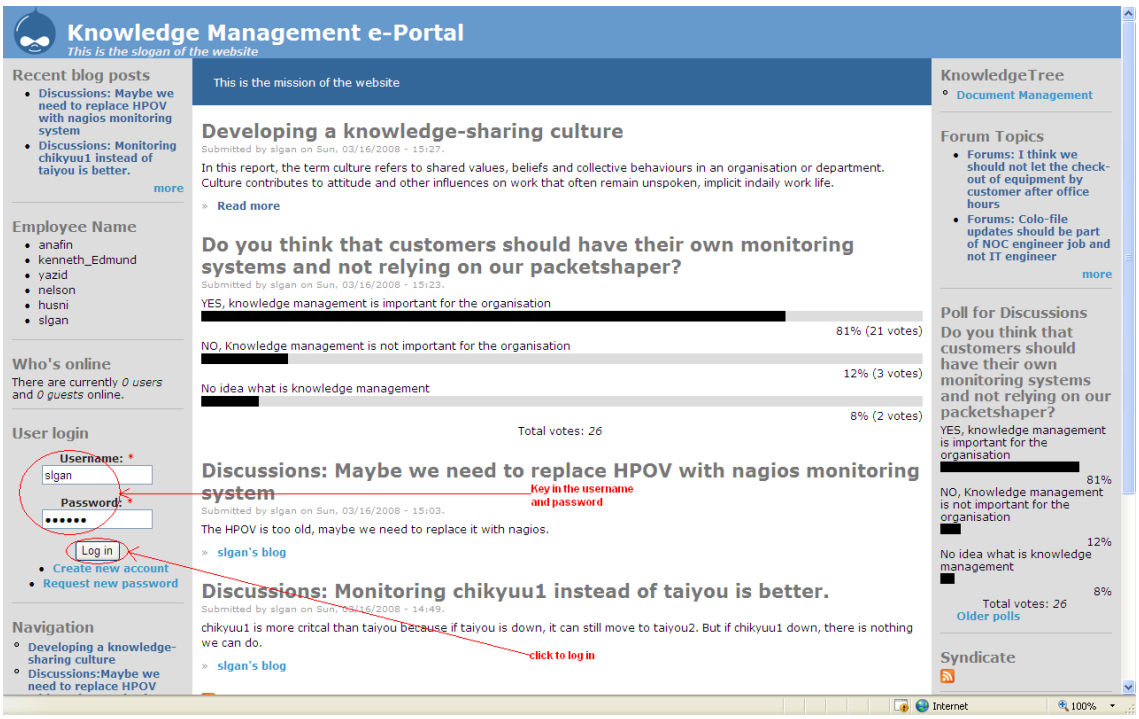

Figure 21: Screenshot of Login Page to Knowledge Management e-Portal

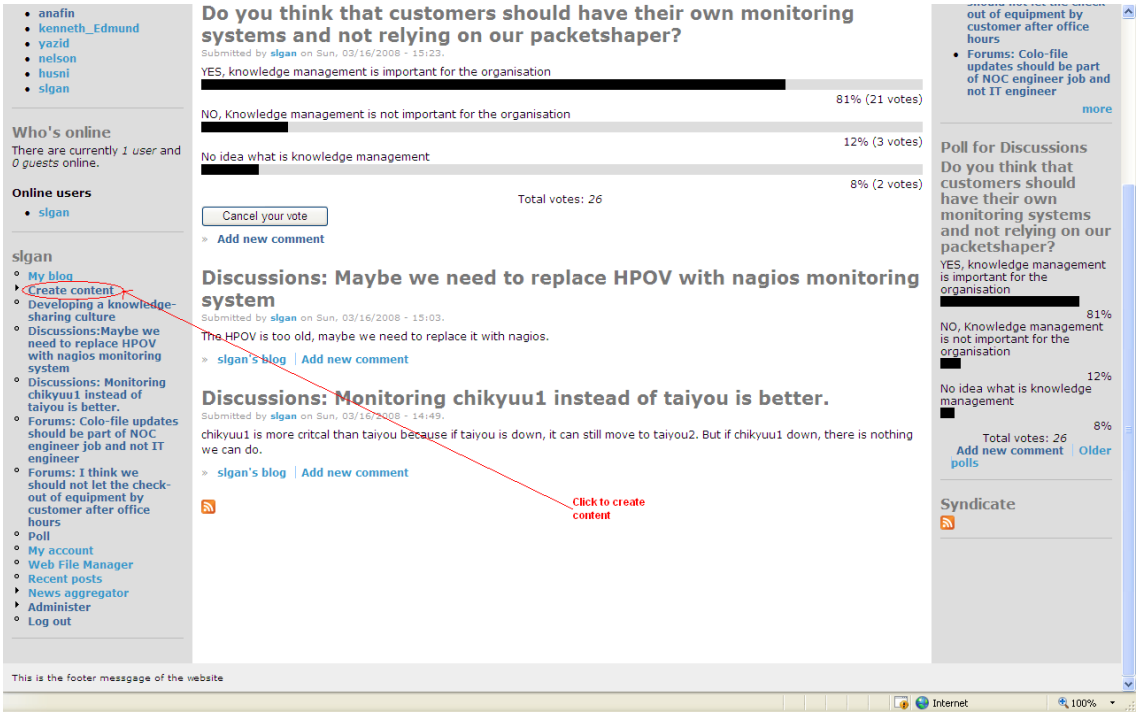

Figure 22: Screenshot of Creating Blogs in the Knowledge Management e-Portal (1)

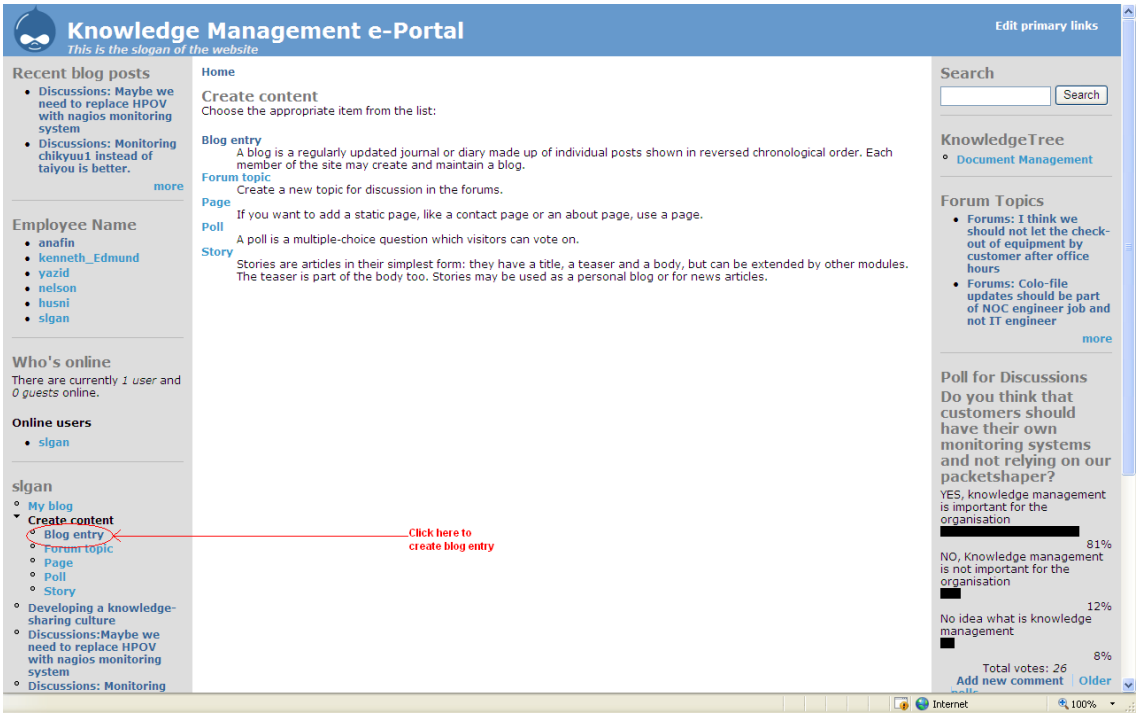

Figure 23: Screenshot of Creating Blogs in the Knowledge Management e-Portal (2)

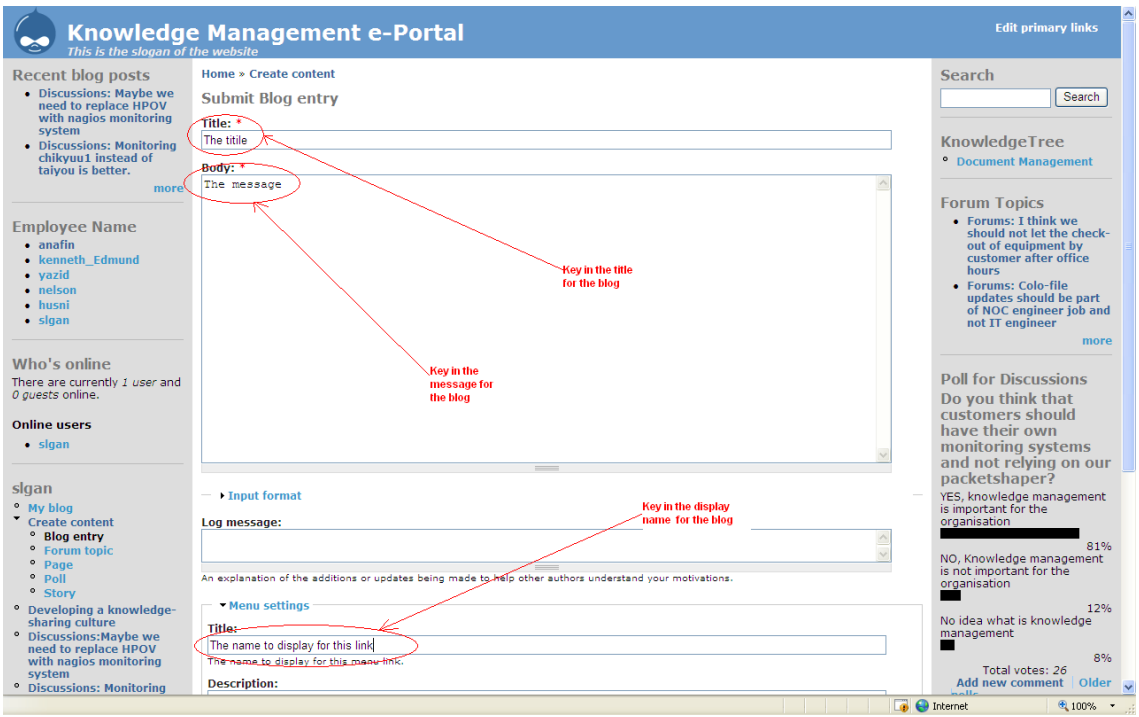

Figure 24: Screenshot of Creating Blogs in the Knowledge Management e-Portal (3)

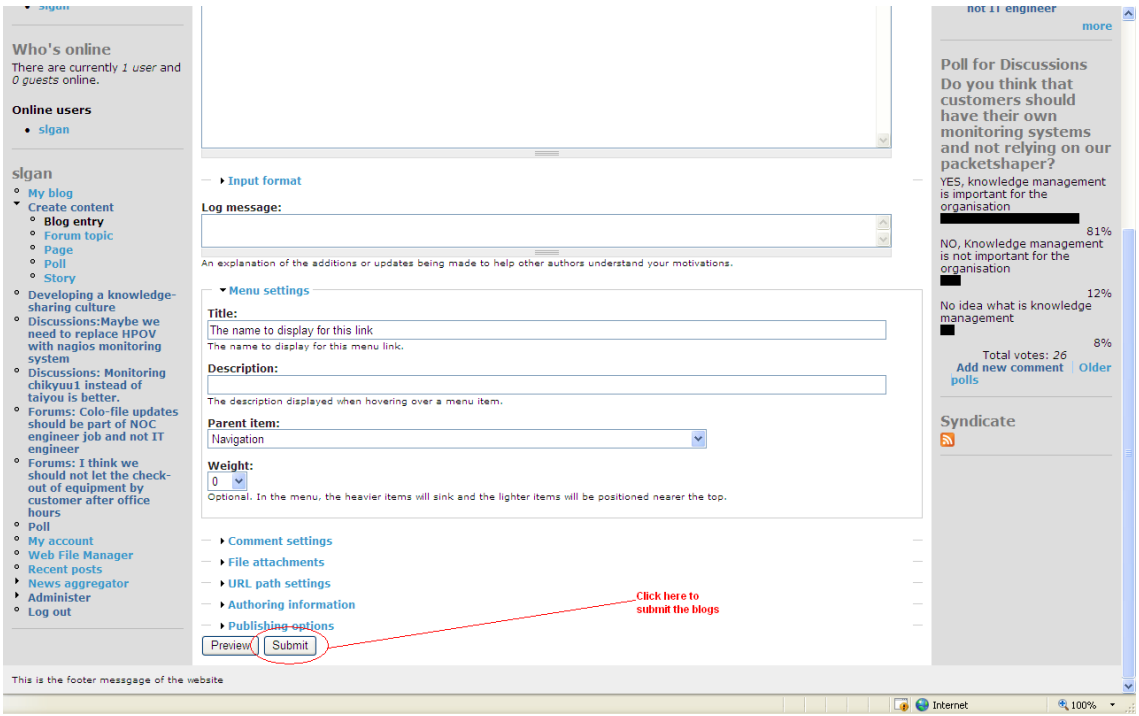

Figure 25: Screenshot of Creating Blogs in the Knowledge Management e-Portal (4)

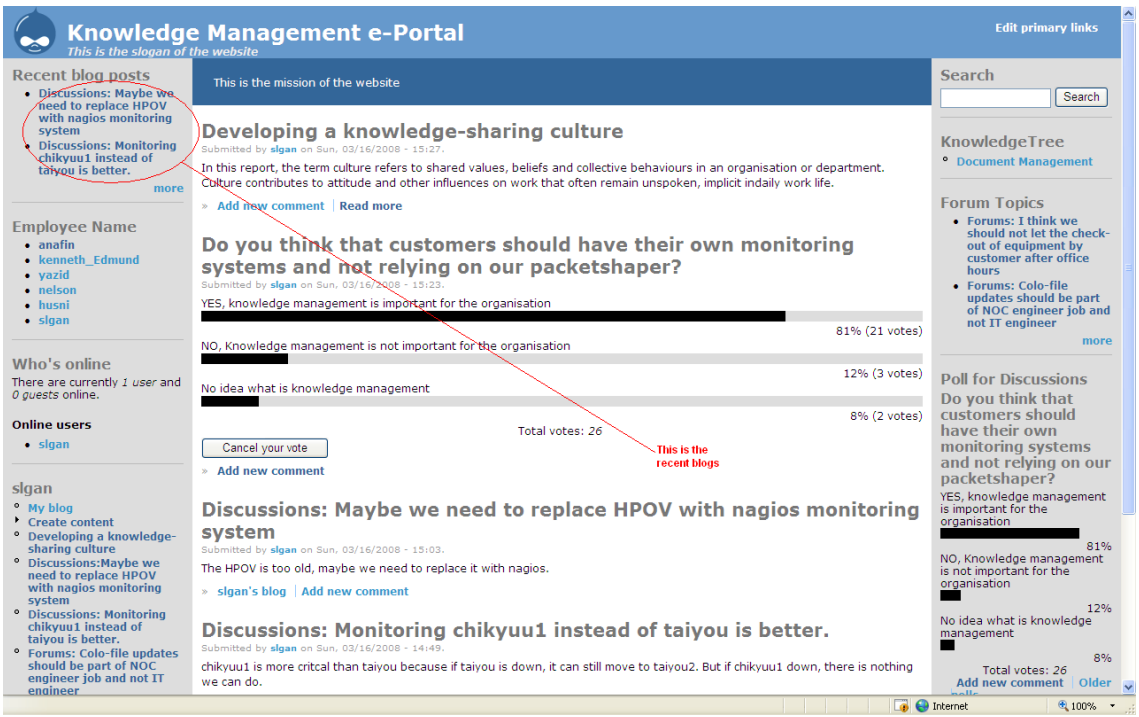

Figure 26: Screenshot of Creating Blogs in the Knowledge Management e-Portal (5)

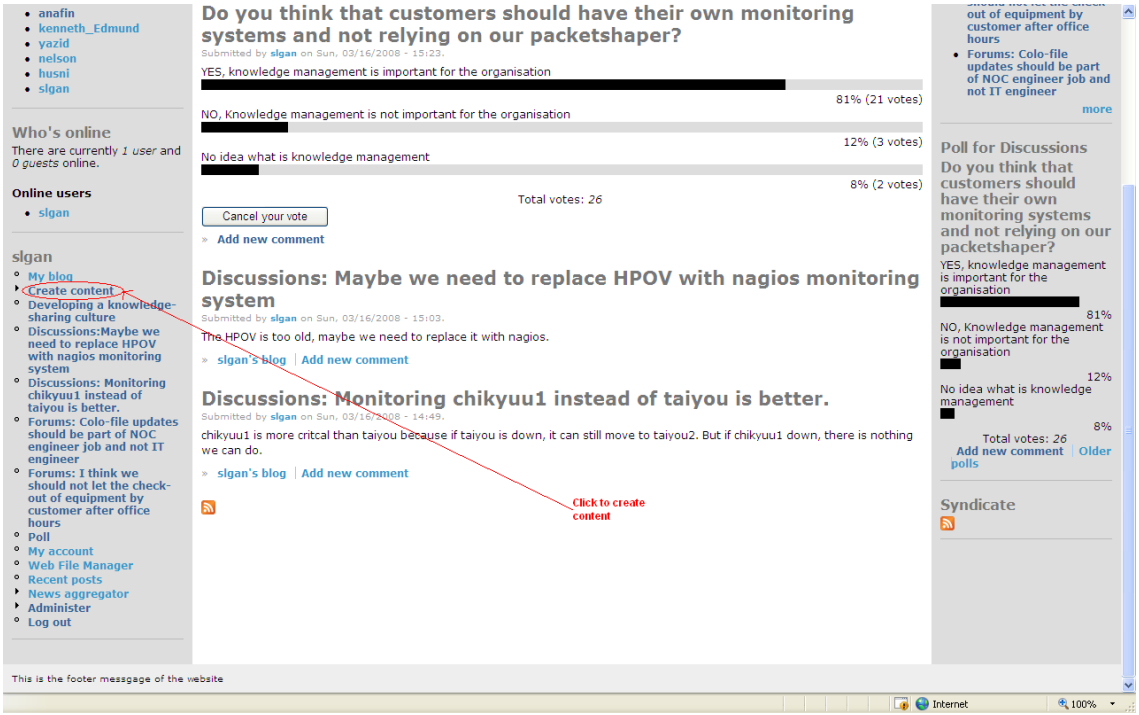

Figure 27: Screenshot of Creating Forums in the Knowledge Management e-Portal (1)

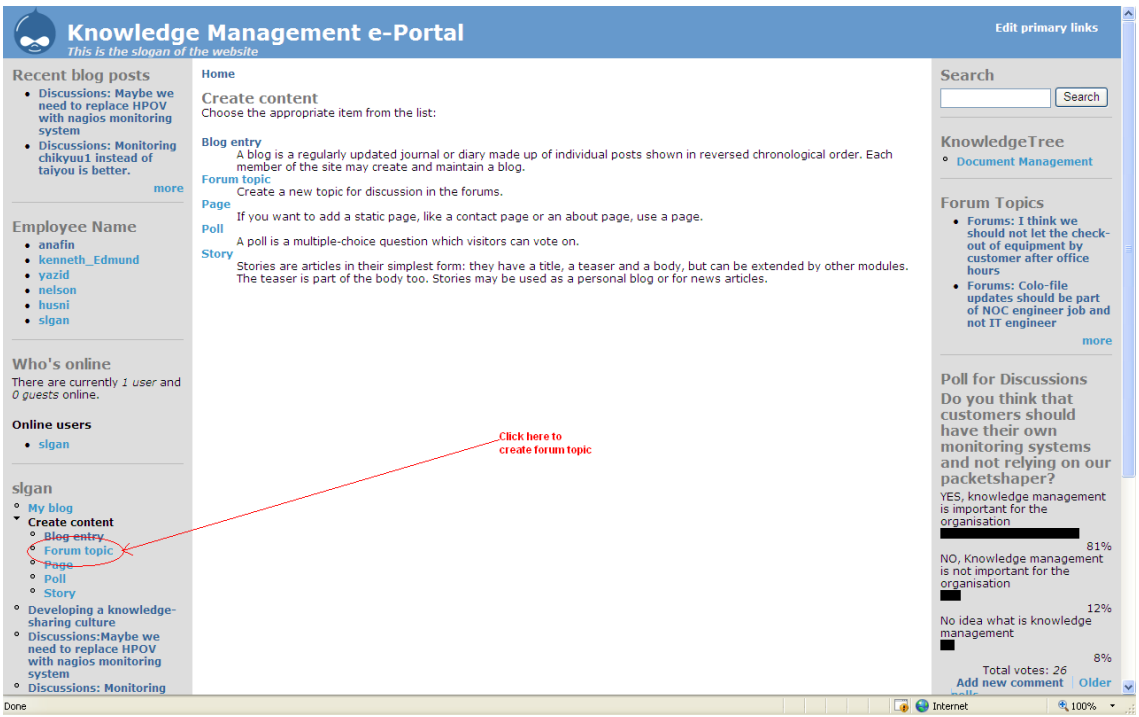

Figure 28: Screenshot of Creating Forums in the Knowledge Management e-Portal (2)

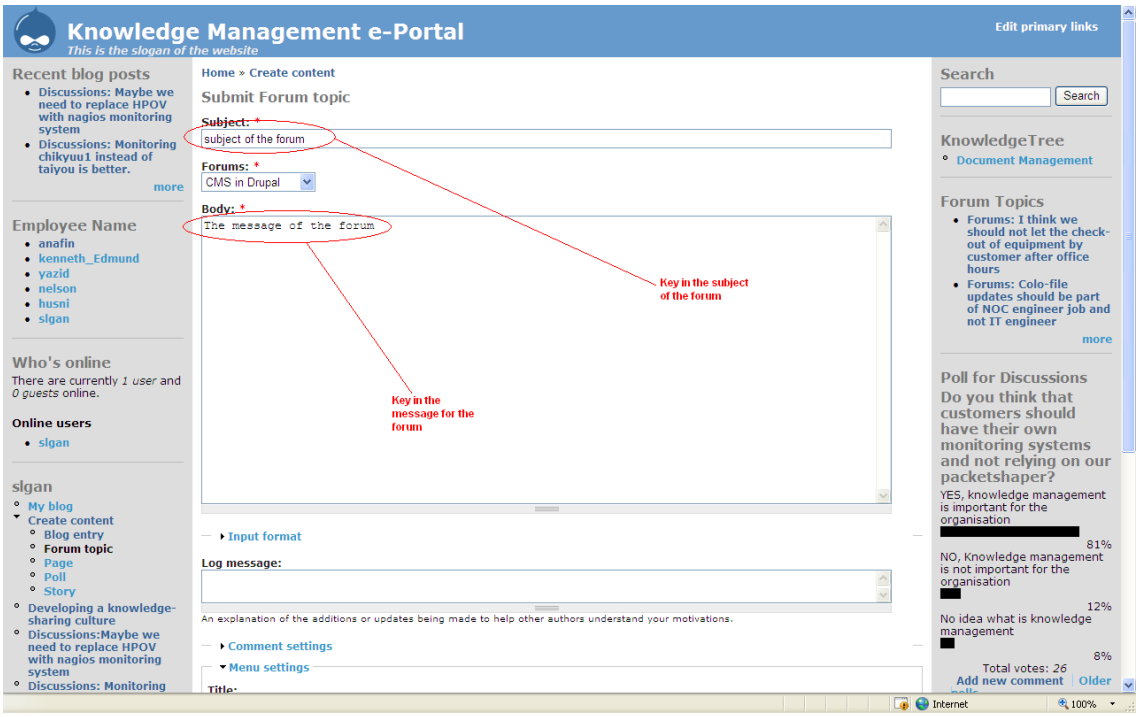

Figure 29: Screenshot of Creating Forums in the Knowledge Management e-Portal (3)

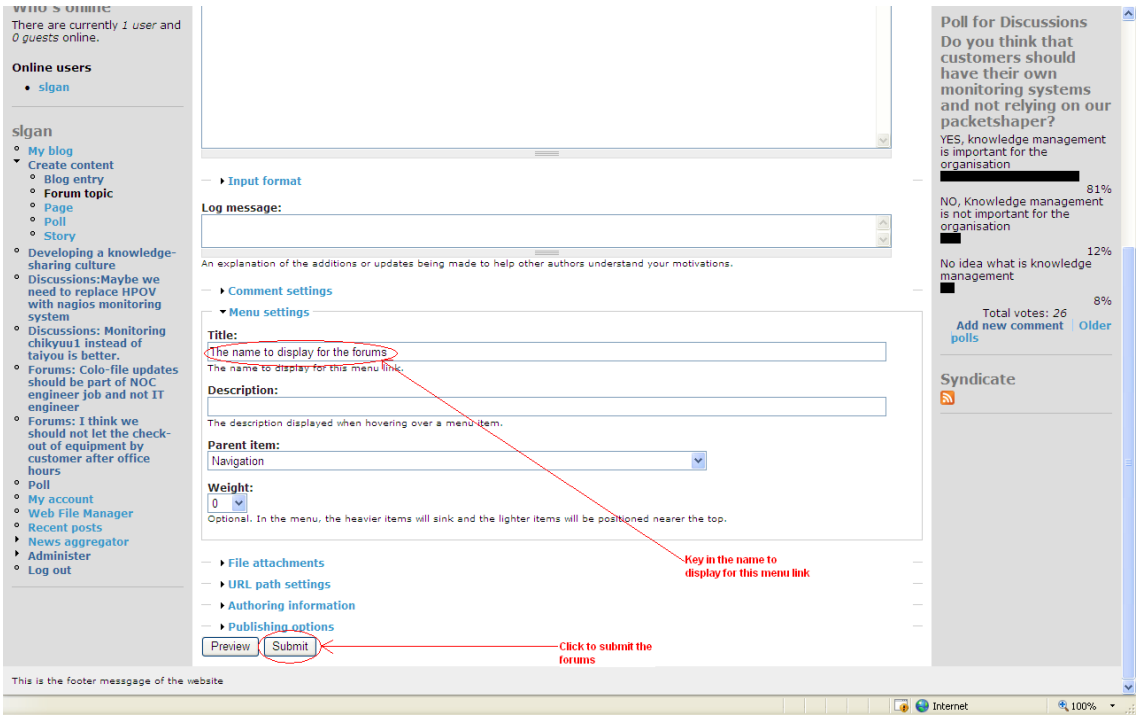

Figure 30: Screenshot of Creating Forums in the Knowledge Management e-Portal (4)

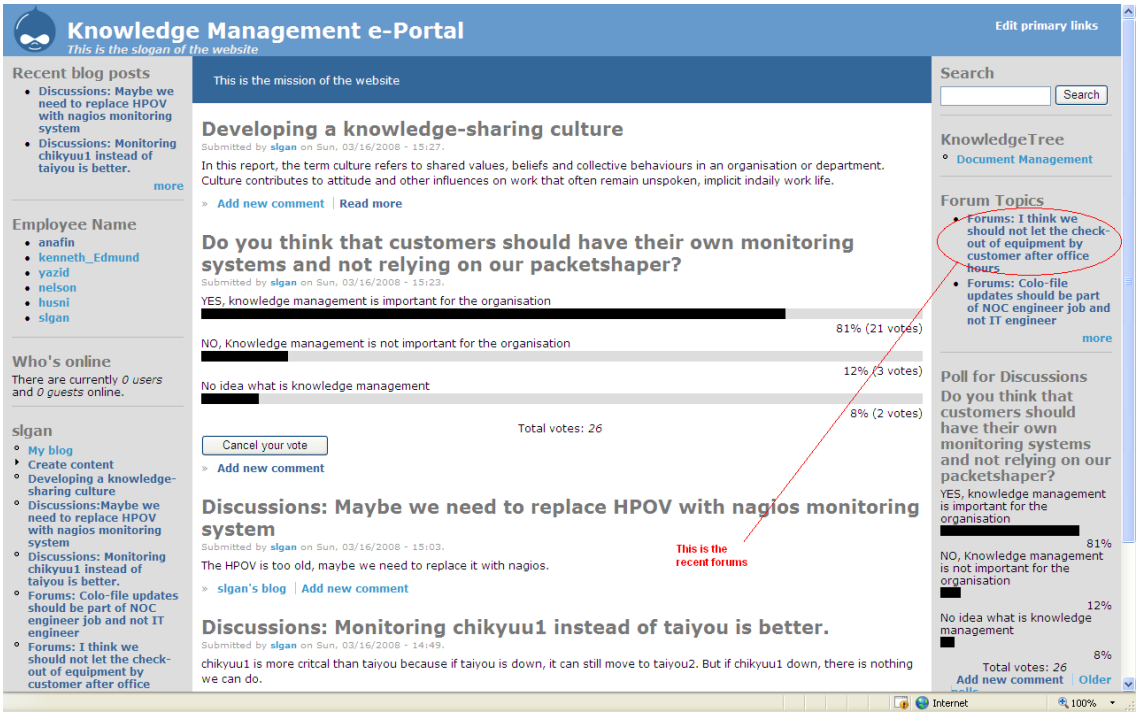

Figure 31: Screenshot of Creating Forums in the Knowledge Management e-Portal (5)

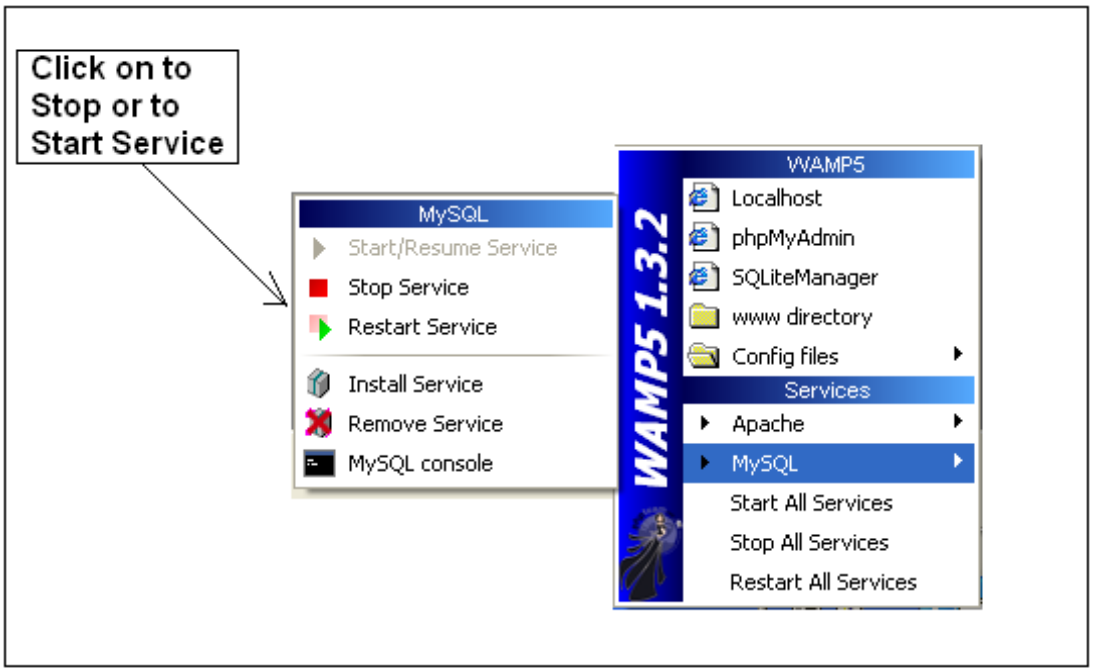

Figure 32: Screenshot to Start and Stop MySQL's Services

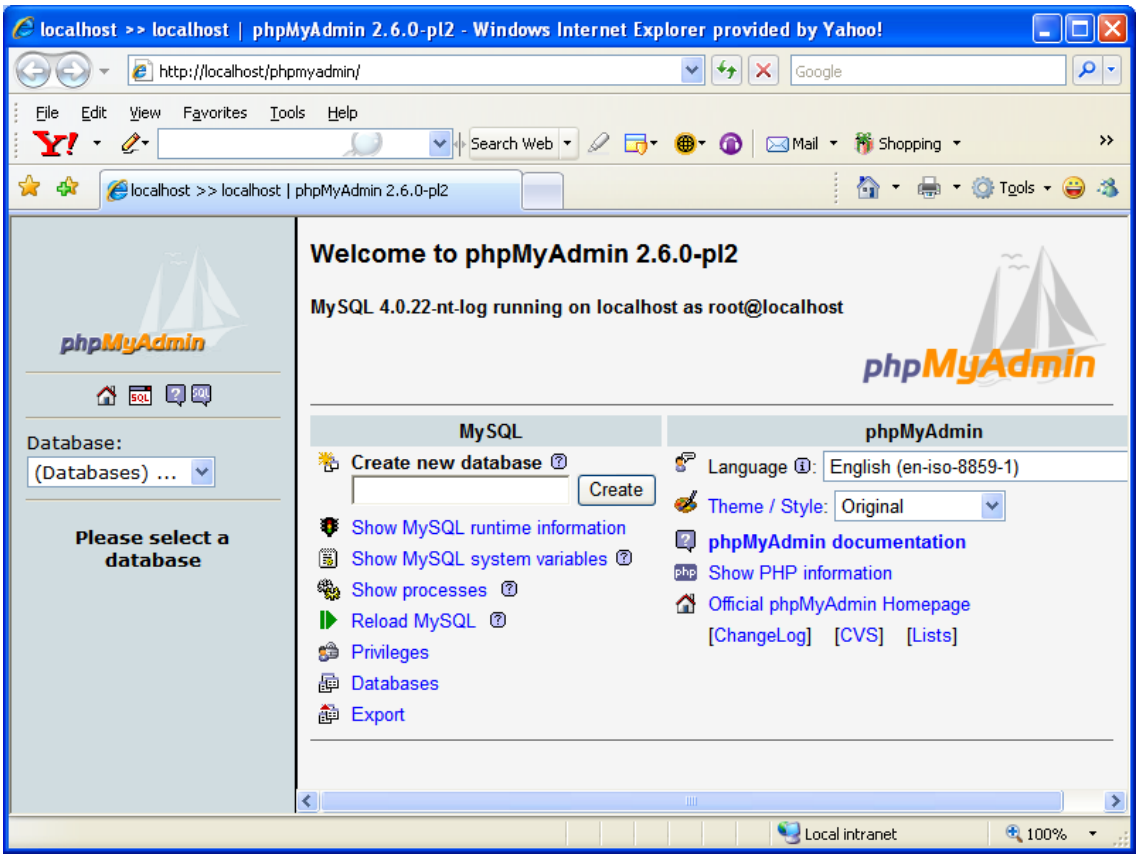

Figure 33: Screenshot of phpMyAdmin for Database Administration

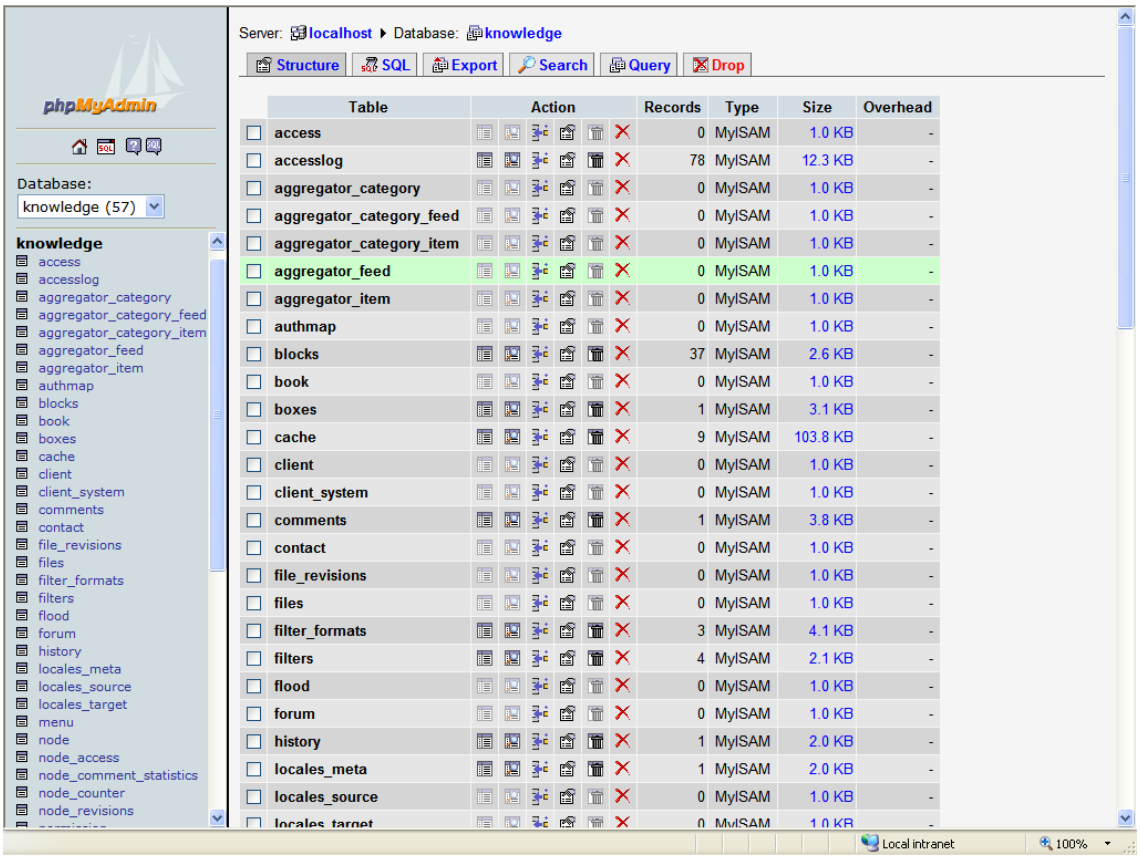

Figure 34: Screenshot of Database Tables Using phpMyAdmin

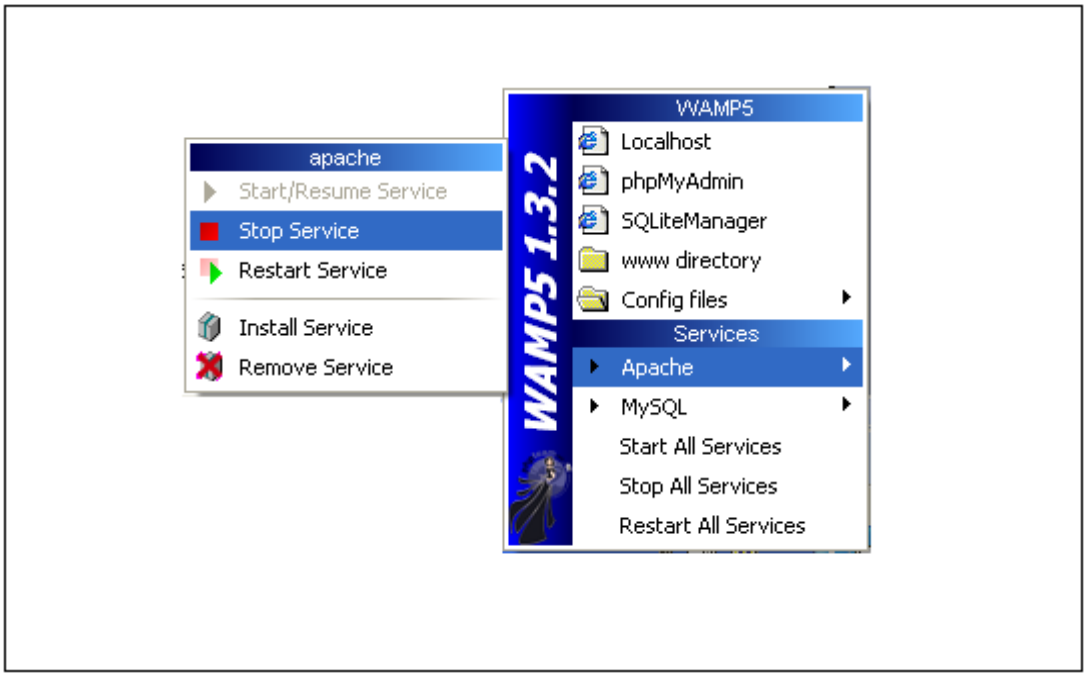

Figure 35: Screenshot to Start and Stop Apache's Services

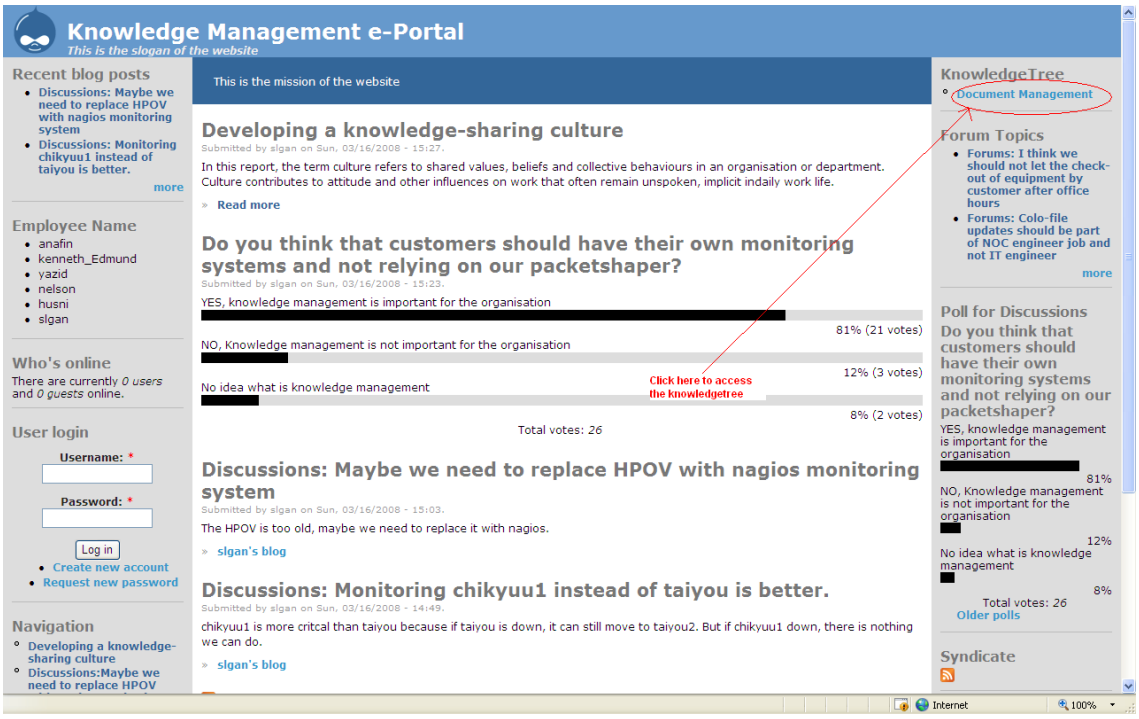

Figure 36: Screenshot to Access KnowledgeTree

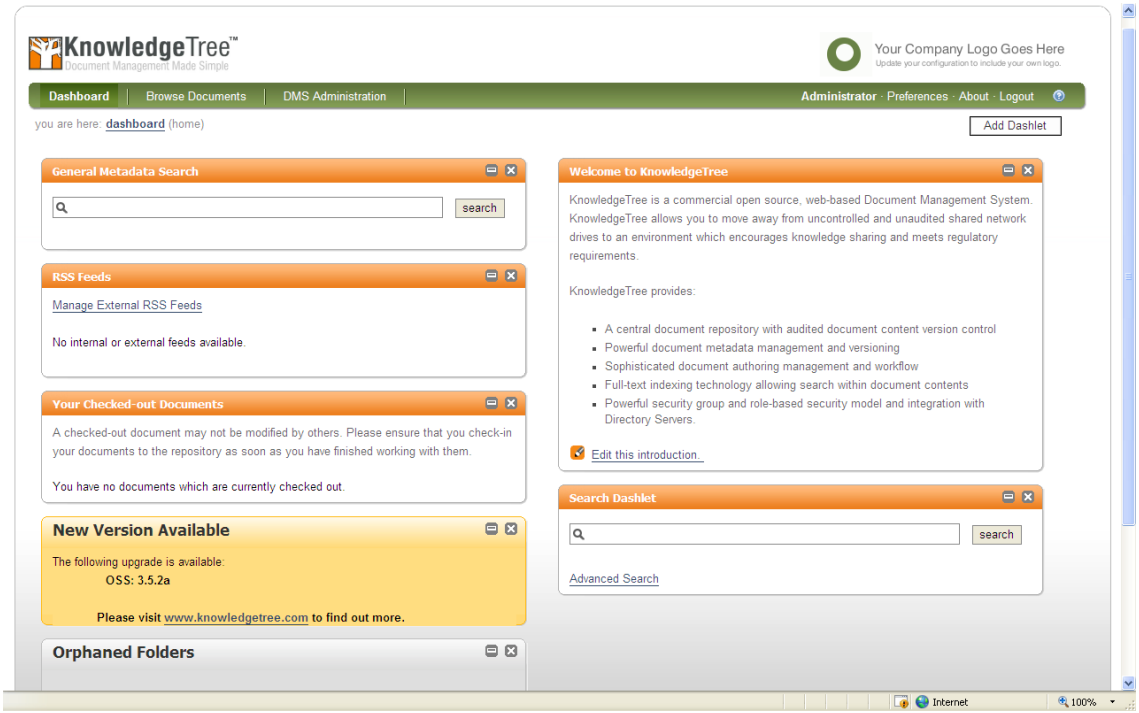

Figure 37: Screenshot of Dashboard in KnowledgeTree

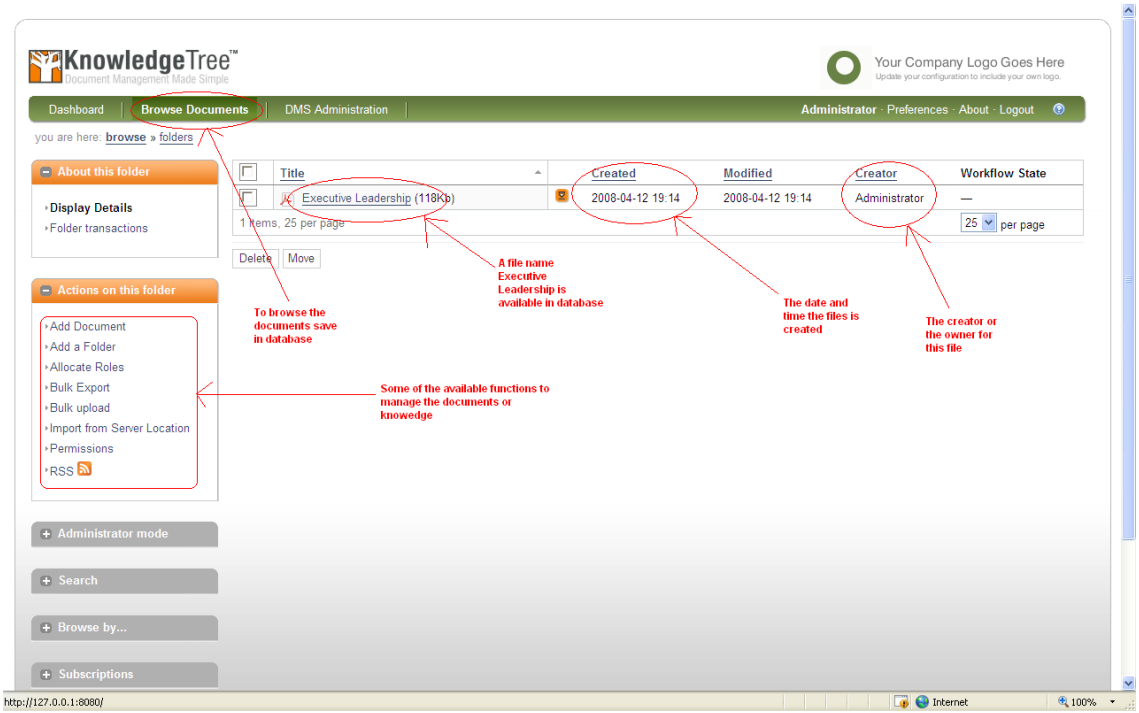

Figure 38: Screenshot of Browse Documents in KnowledgeTree

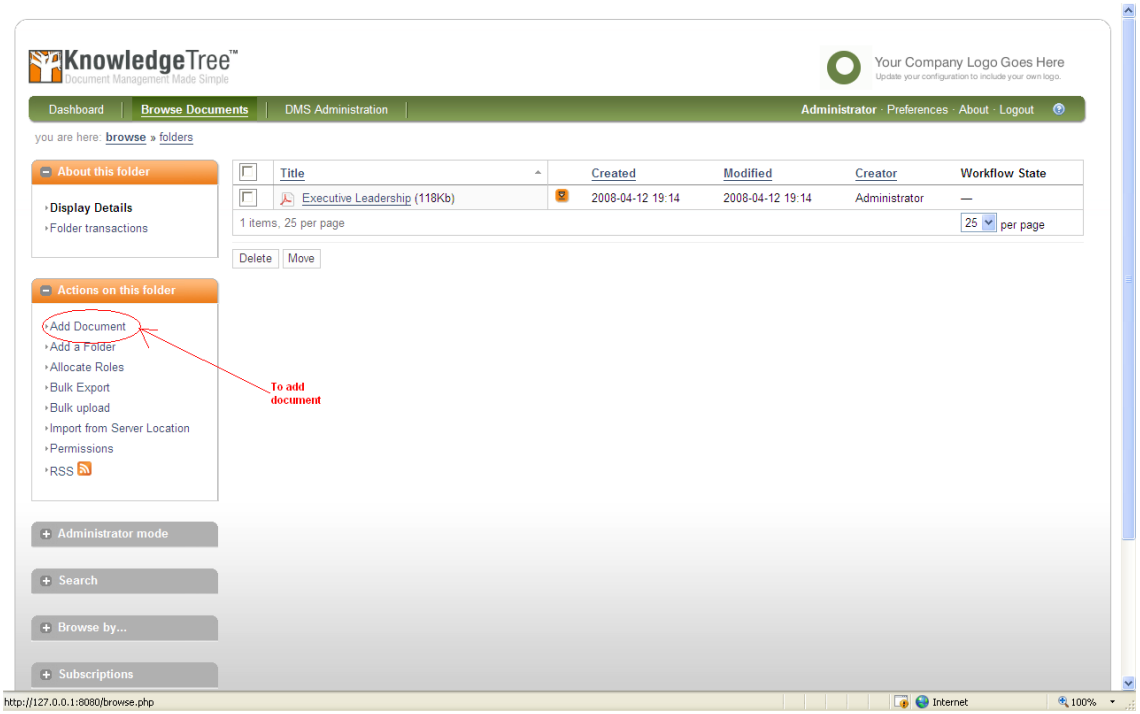

Figure 39: Screenshot of Adding Documents in KnowledgeTree (1)

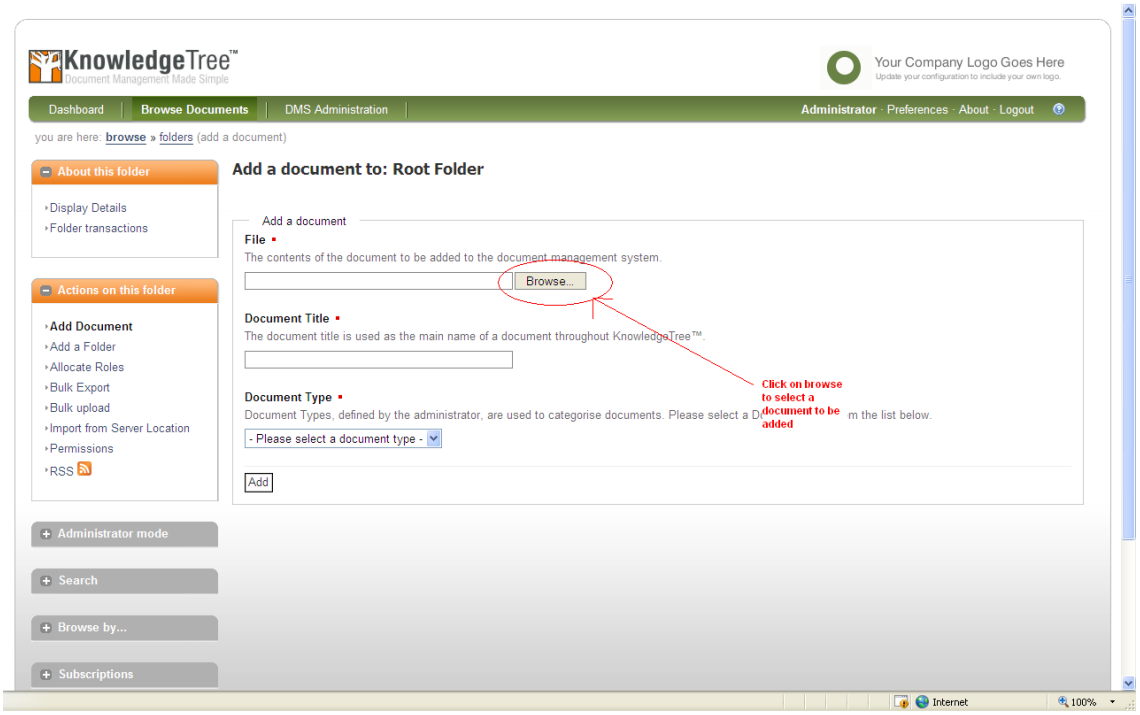

Figure 40: Screenshot of Adding Documents in KnowledgeTree (2)

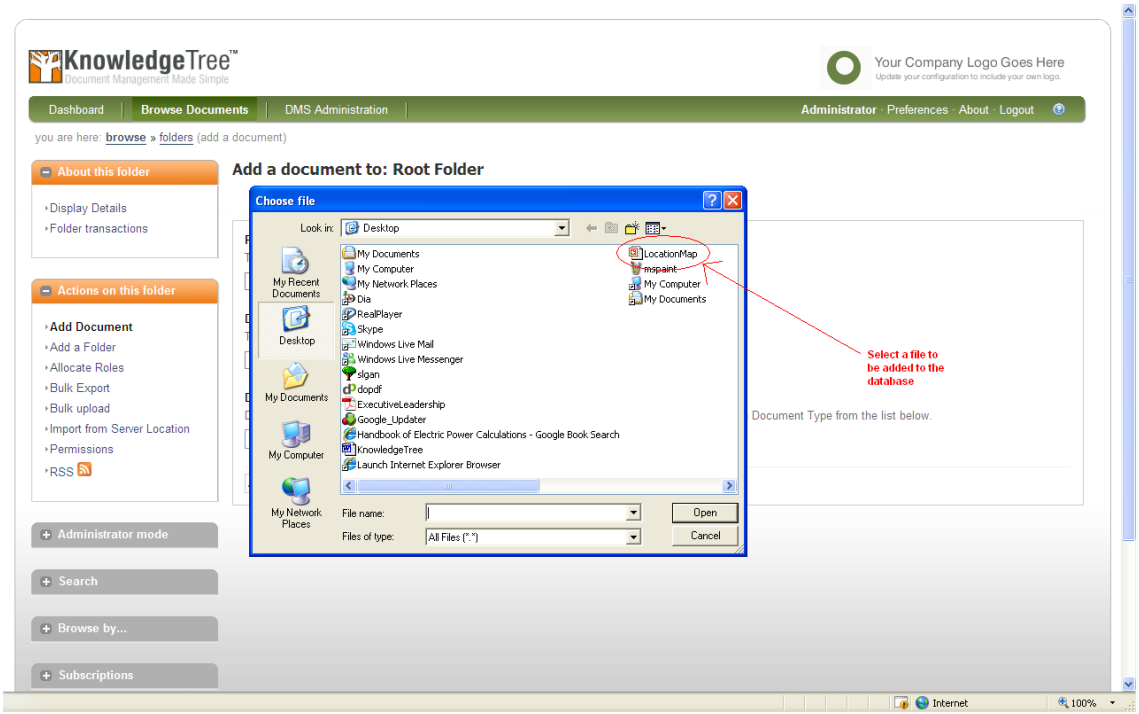

Figure 41: Screenshot of Adding Documents in KnowledgeTree (3)

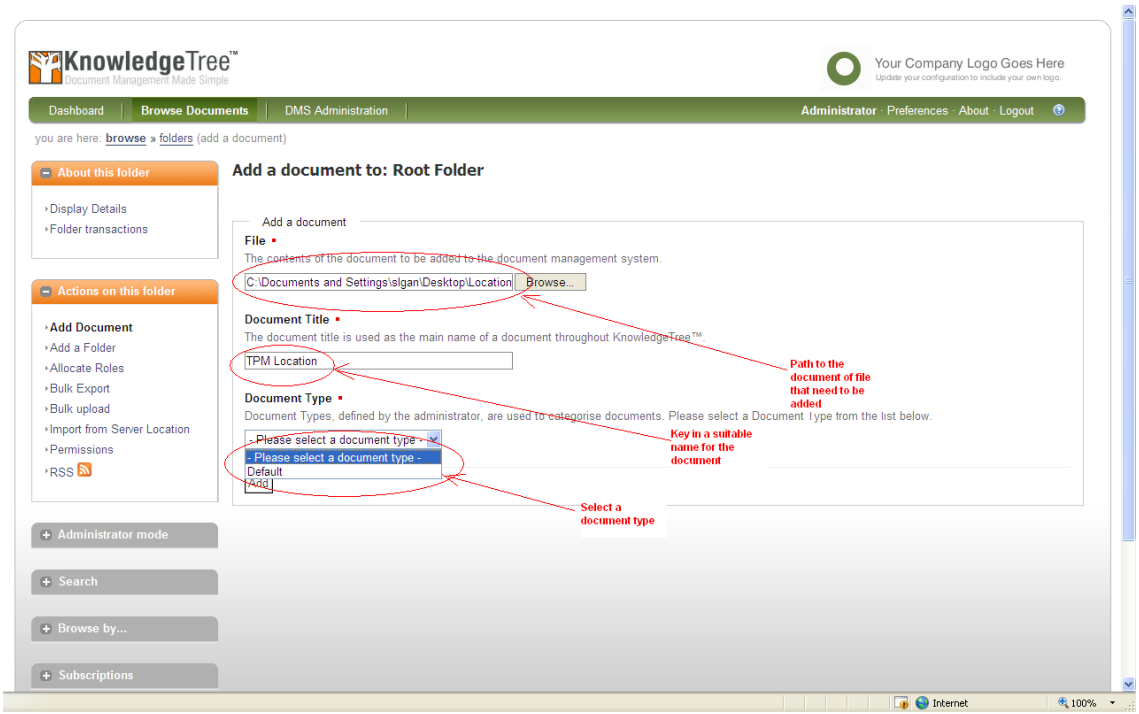

Figure 42: Screenshot of Adding Documents in KnowledgeTree (4)

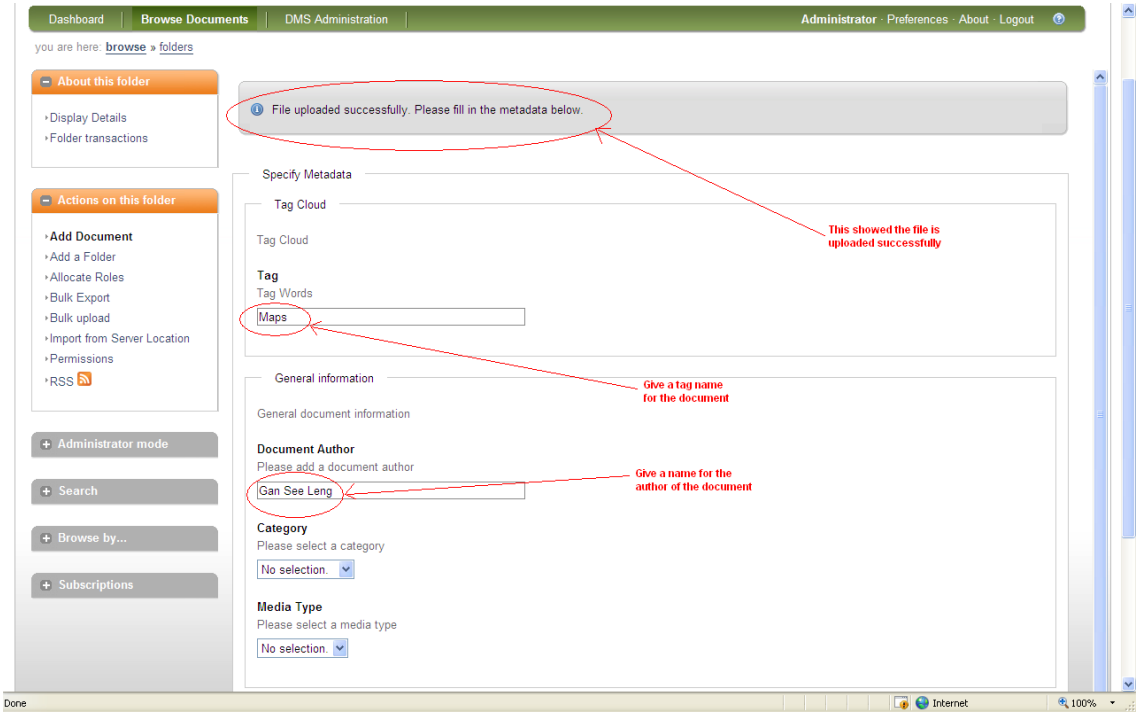

Figure 43: Screenshot of Adding Documents in KnowledgeTree (5)

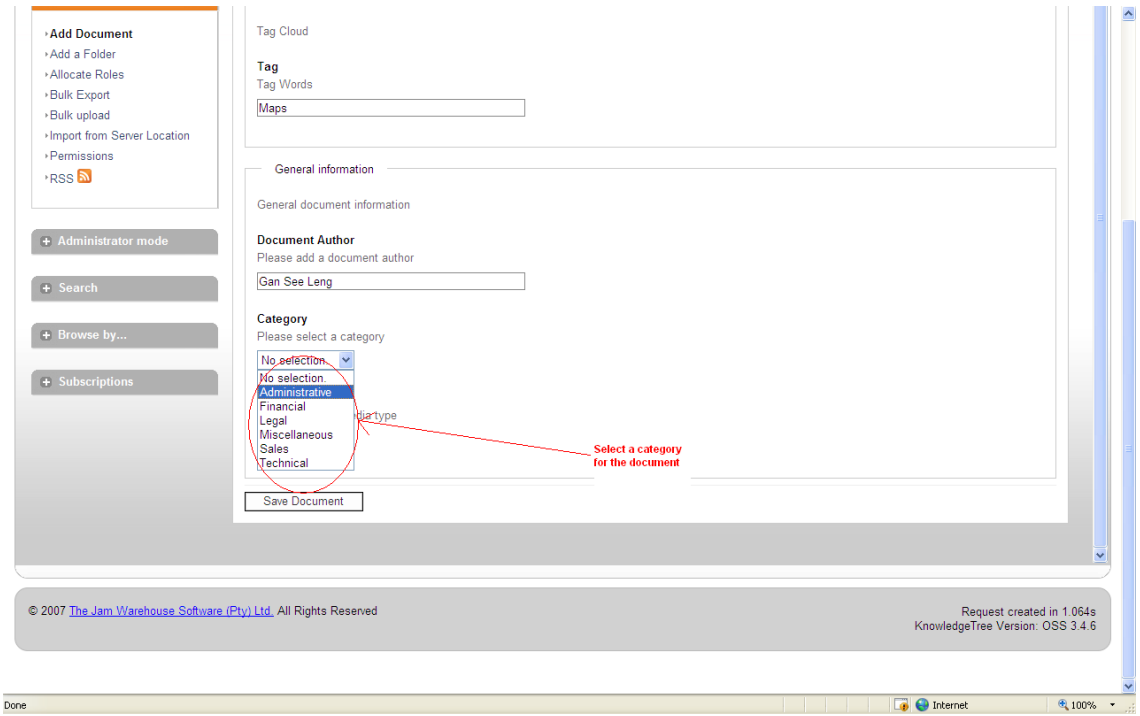

Figure 44: Screenshot of Adding Documents in KnowledgeTree (6)

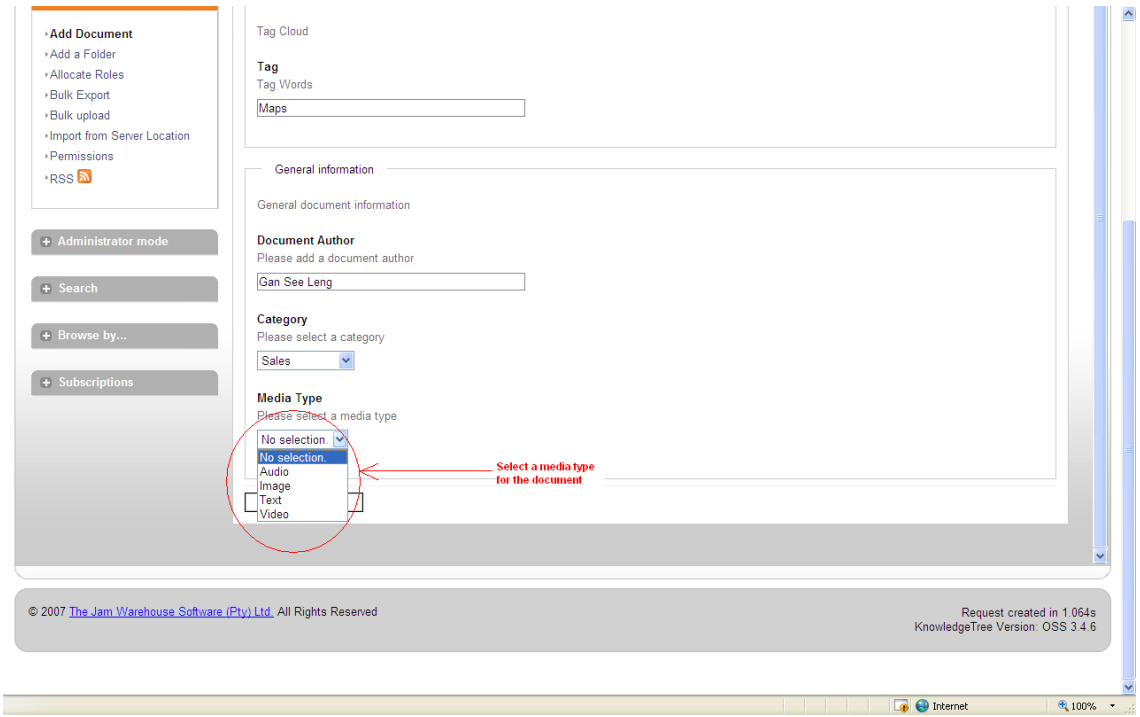

Figure 45: Screenshot of Adding Documents in KnowledgeTree (7)

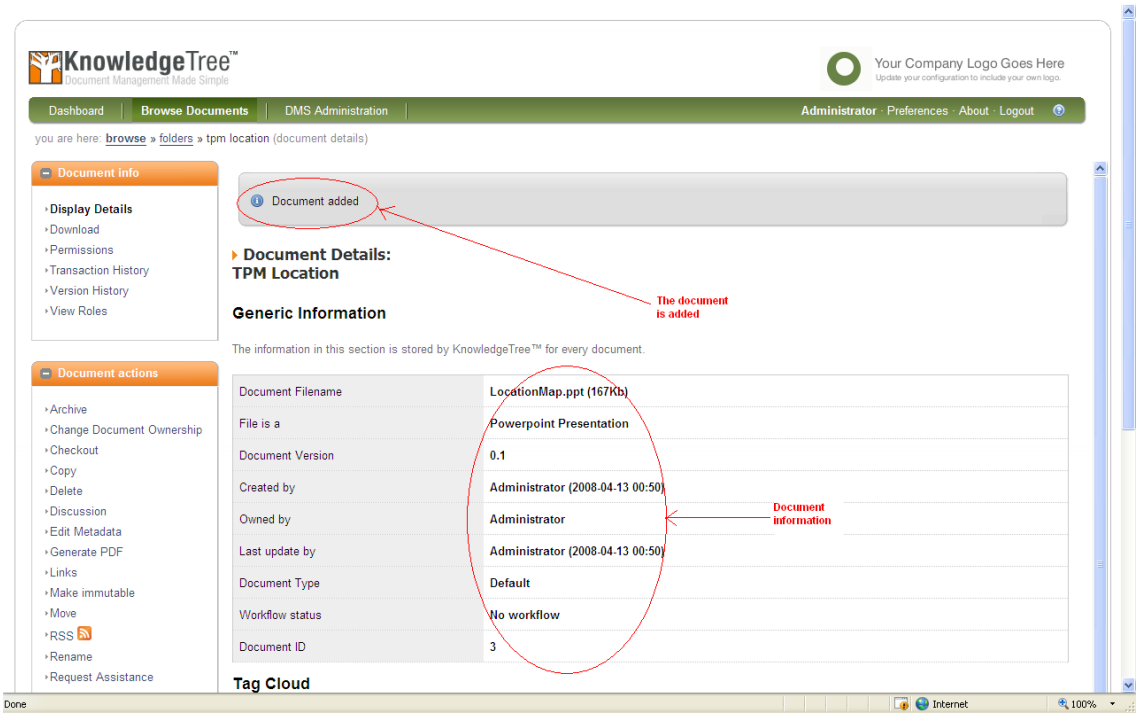

Figure 46: Screenshot of Adding Documents in KnowledgeTree (8)

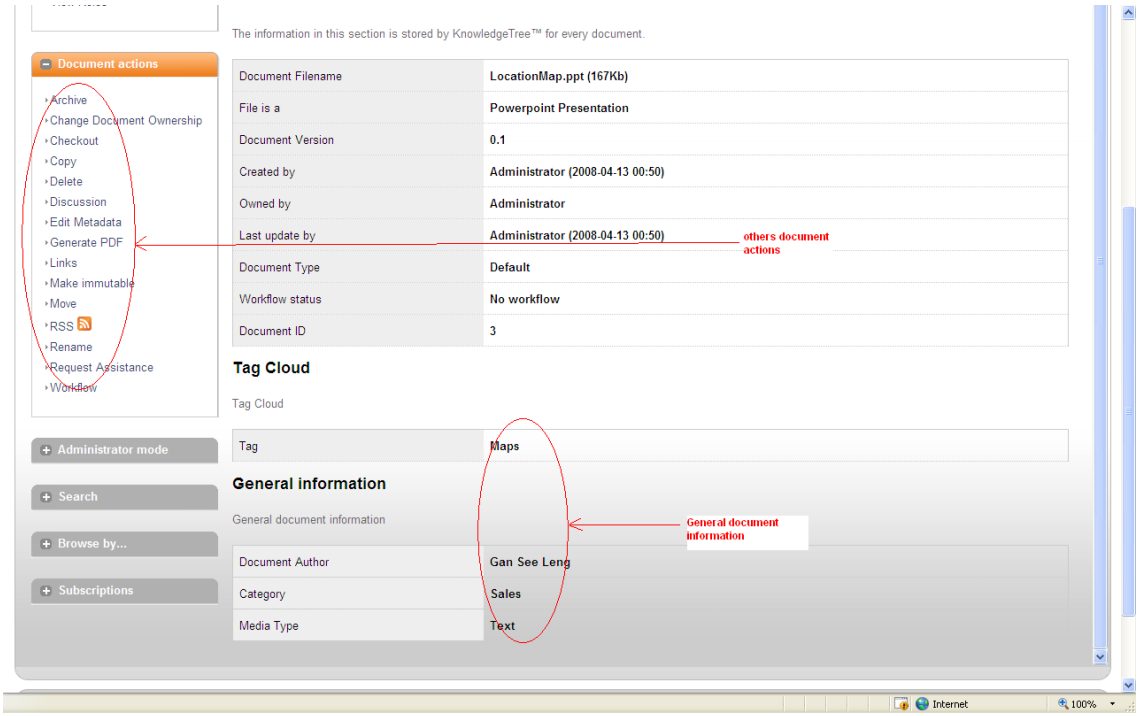

Figure 47: Screenshot of Adding Documents in KnowledgeTree (9)

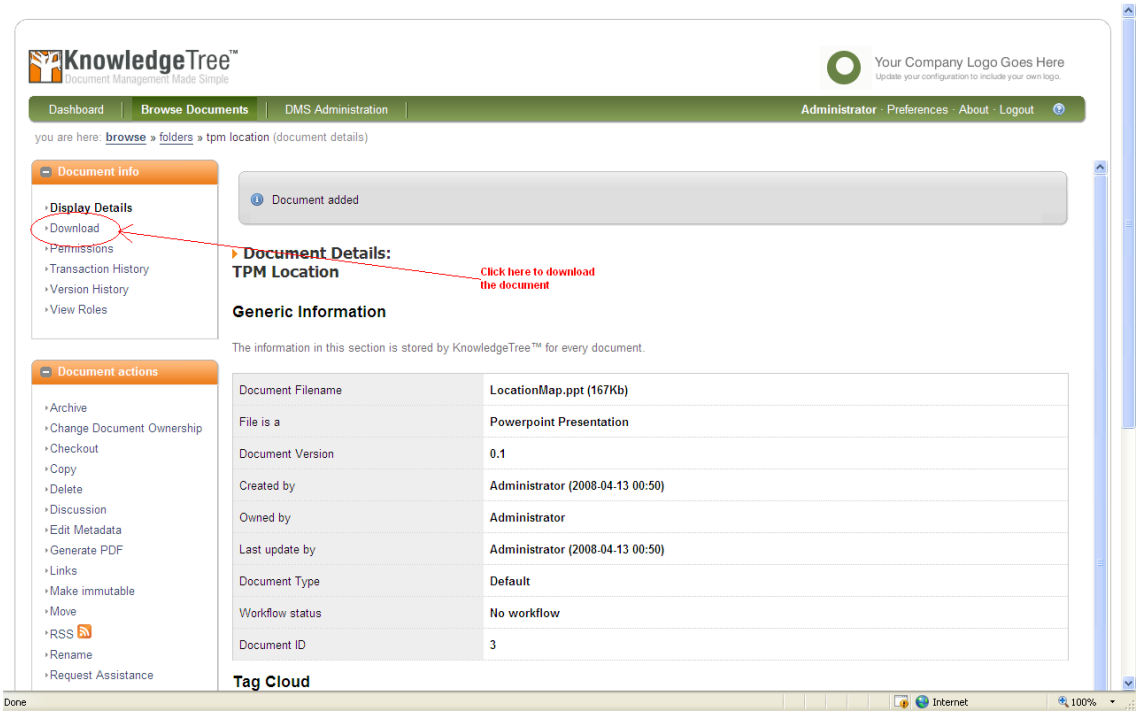

Figure 48: Screenshot of Downloading Documents in KnowledgeTree (1)

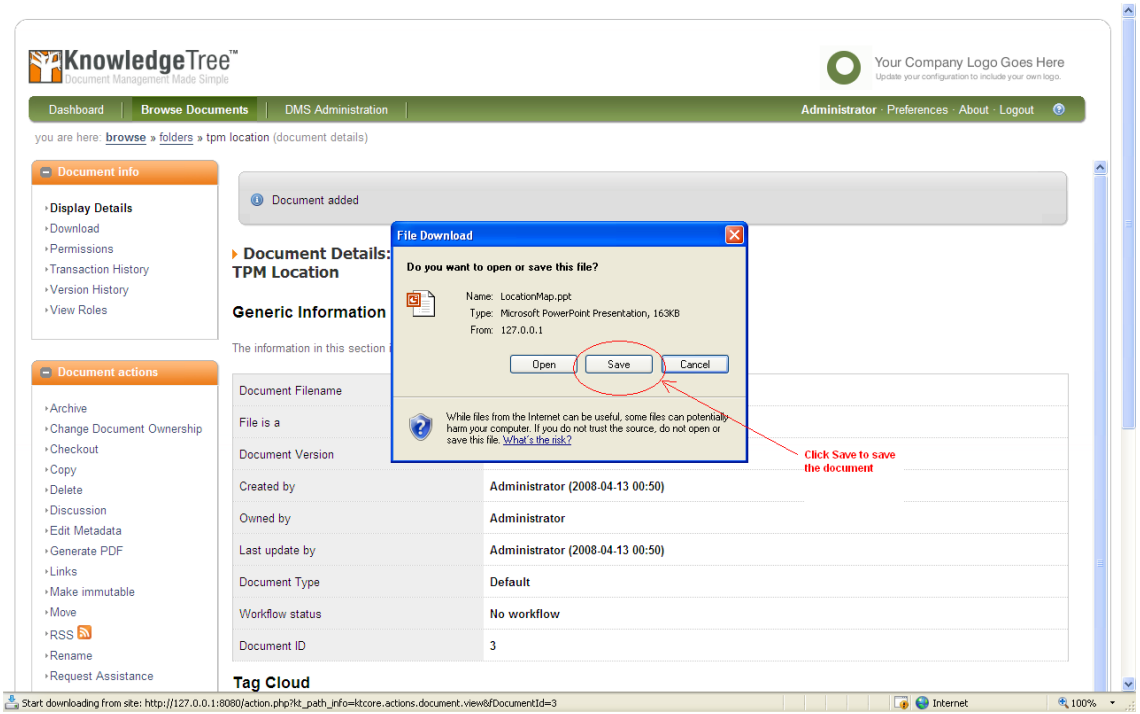

Figure 49: Screenshot of Downloading Documents in KnowledgeTree (2)

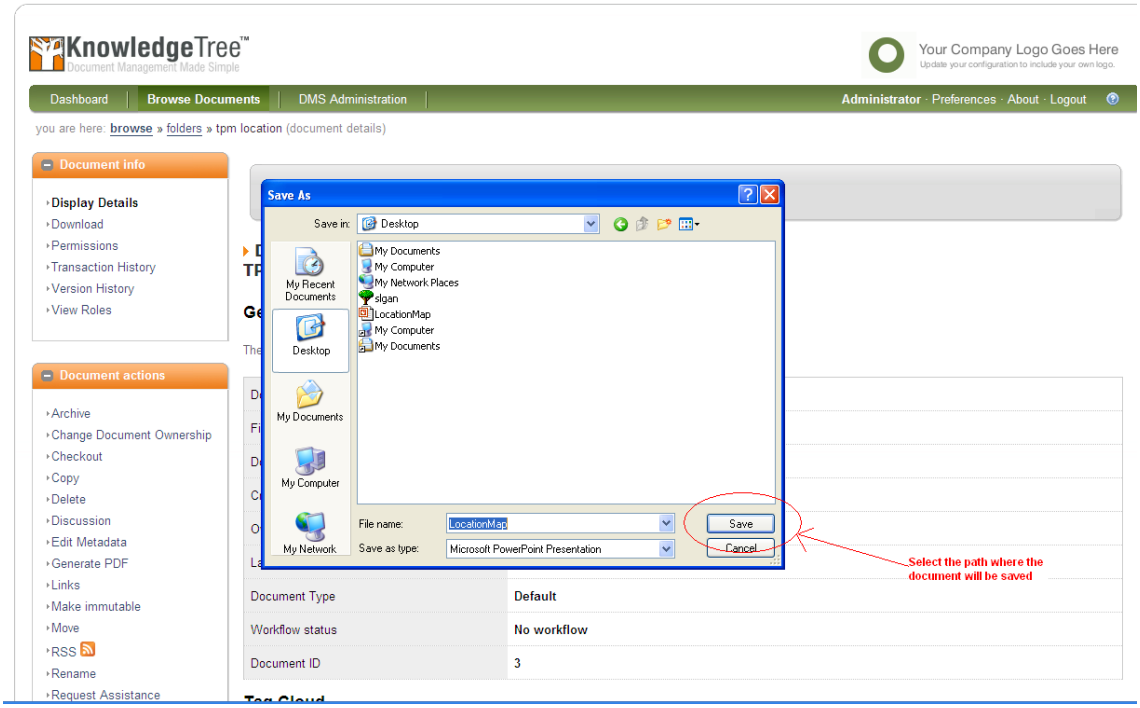

Figure 50: Screenshot of Downloading Documents in KnowledgeTree (3)

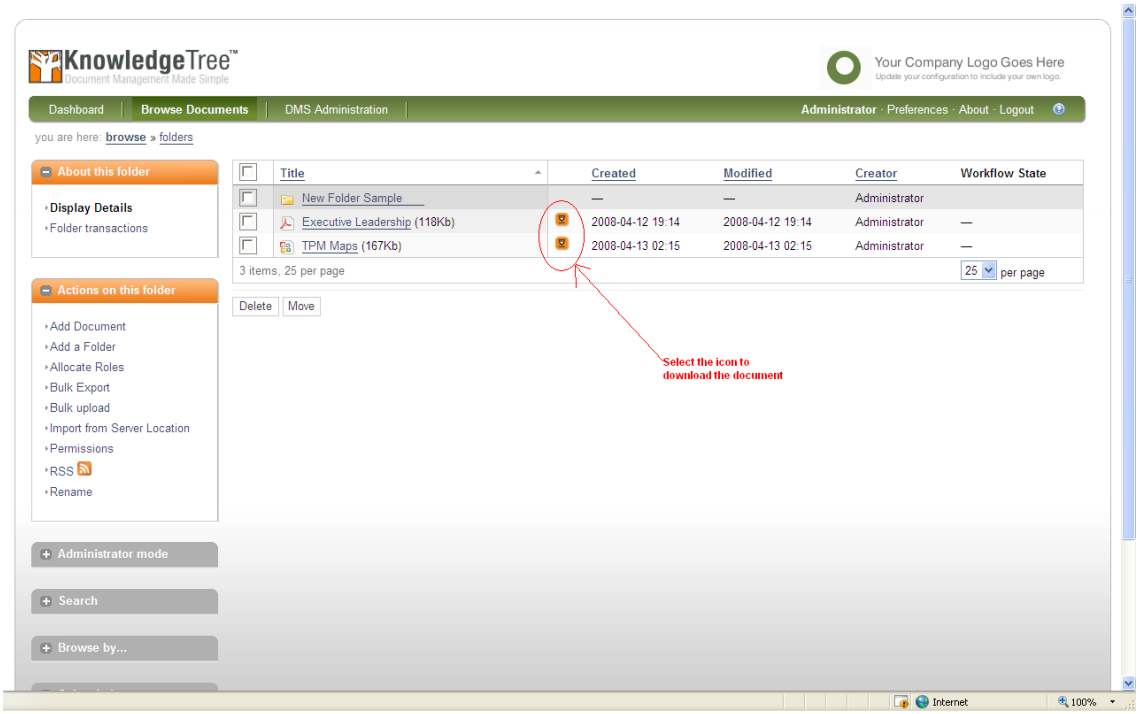

Figure 51: Screenshot of Downloading Documents in KnowledgeTree (4)

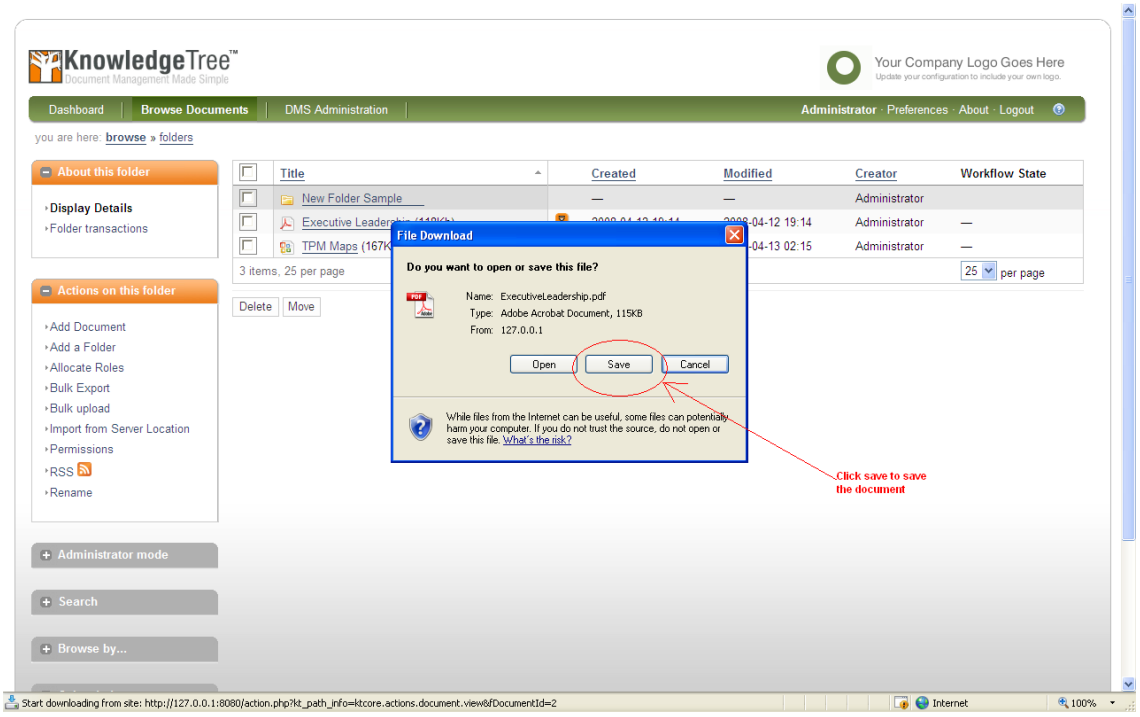

Figure 52: Screenshot of Downloading Documents in KnowledgeTree (5)

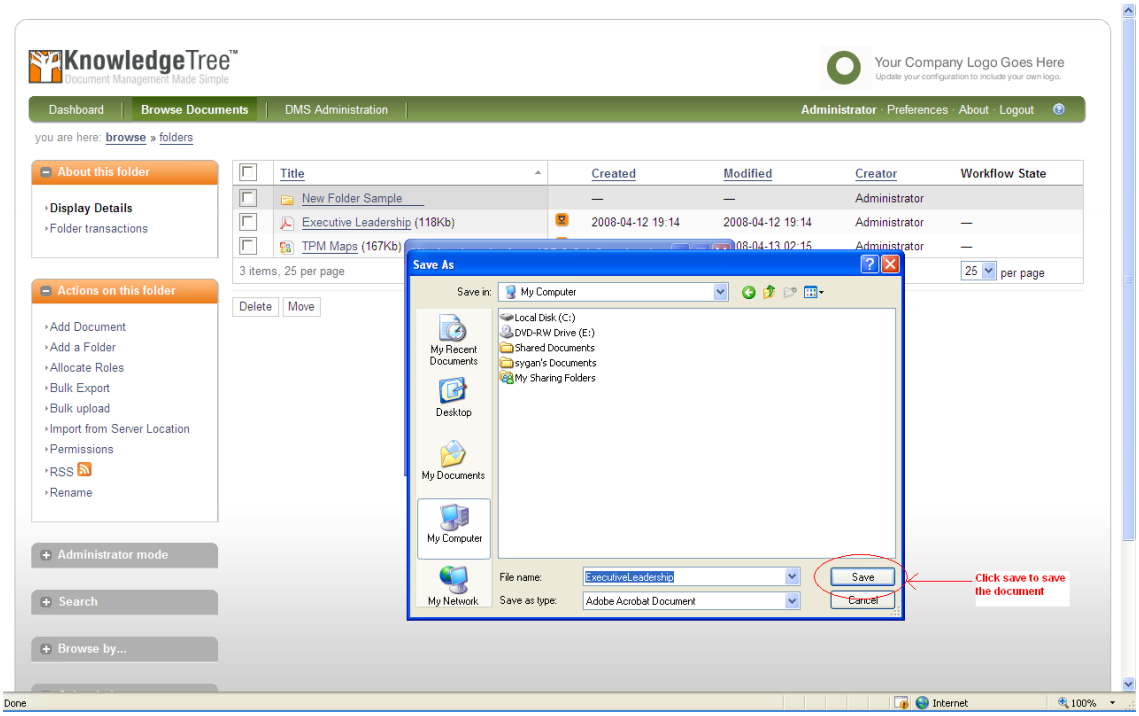

Figure 53: Screenshot of Downloading Documents in KnowledgeTree (6)

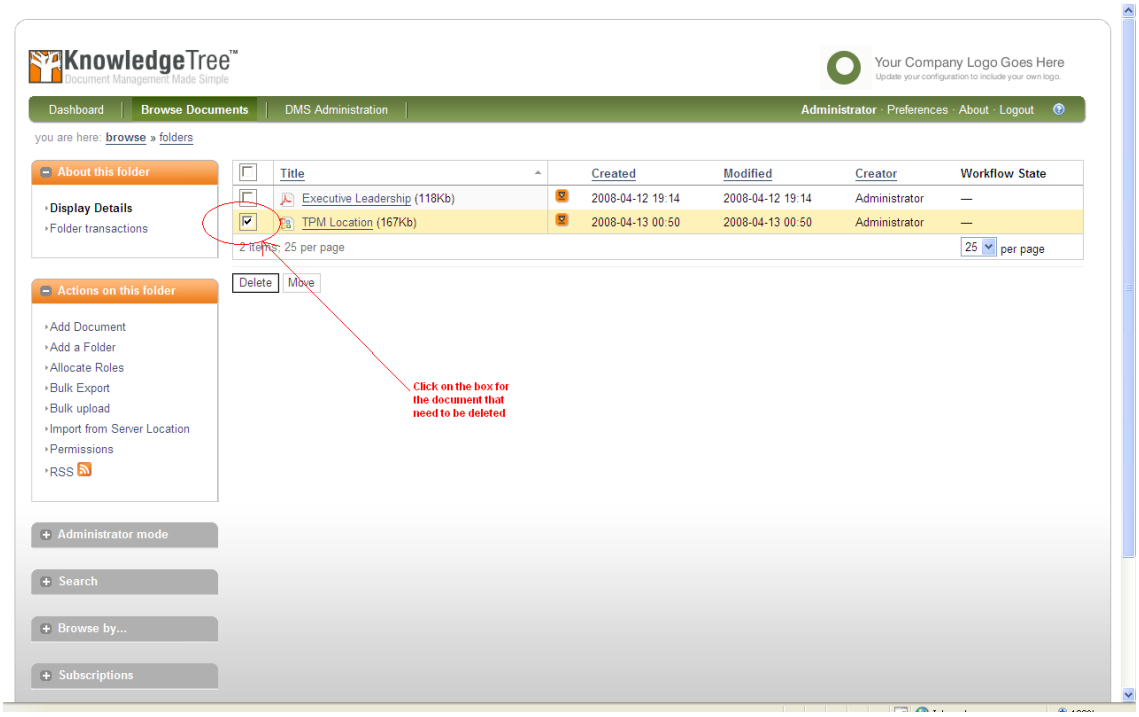

Figure 54: Screenshot of Deleting Documents in KnowledgeTree (1)

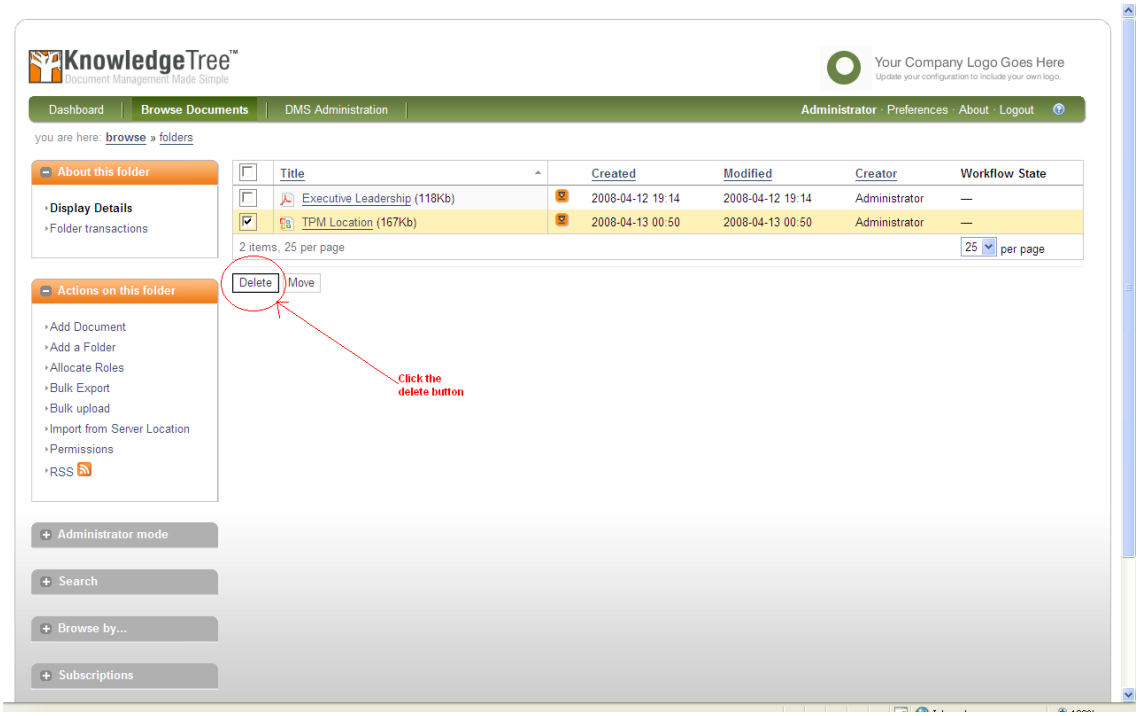

Figure 55: Screenshot of Deleting Documents in KnowledgeTree (2)

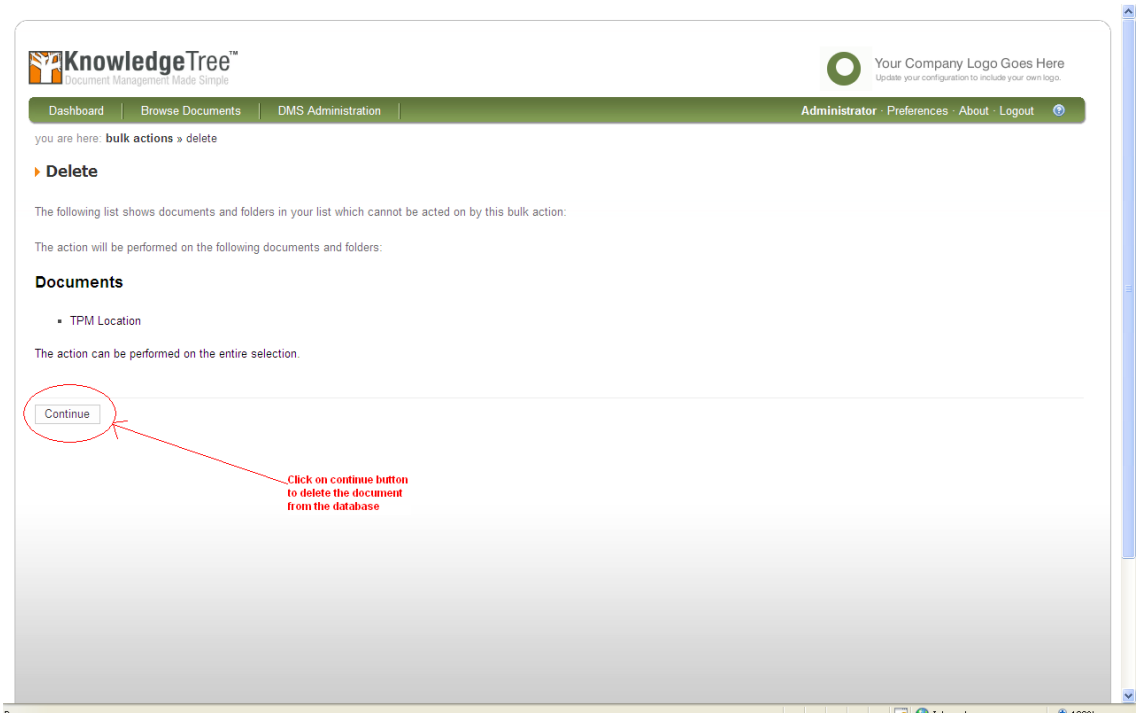

Figure 56: Screenshot of Deleting Documents in KnowledgeTree (3)

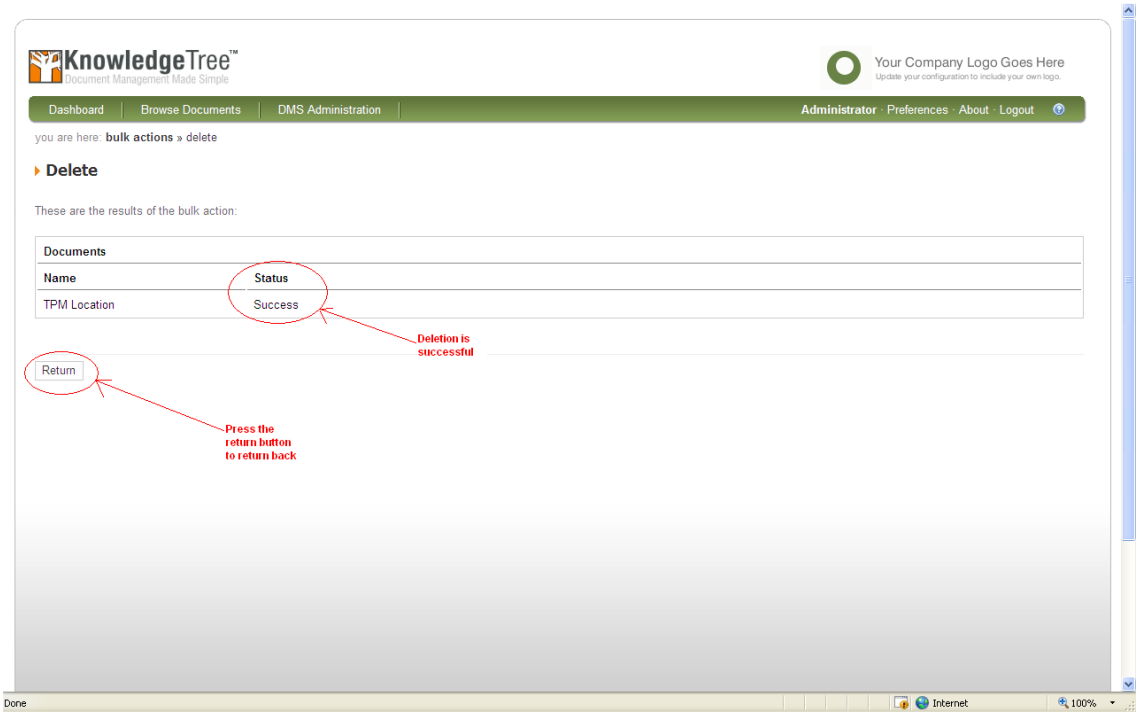

Figure 57: Screenshot of Deleting Documents in KnowledgeTree (4)

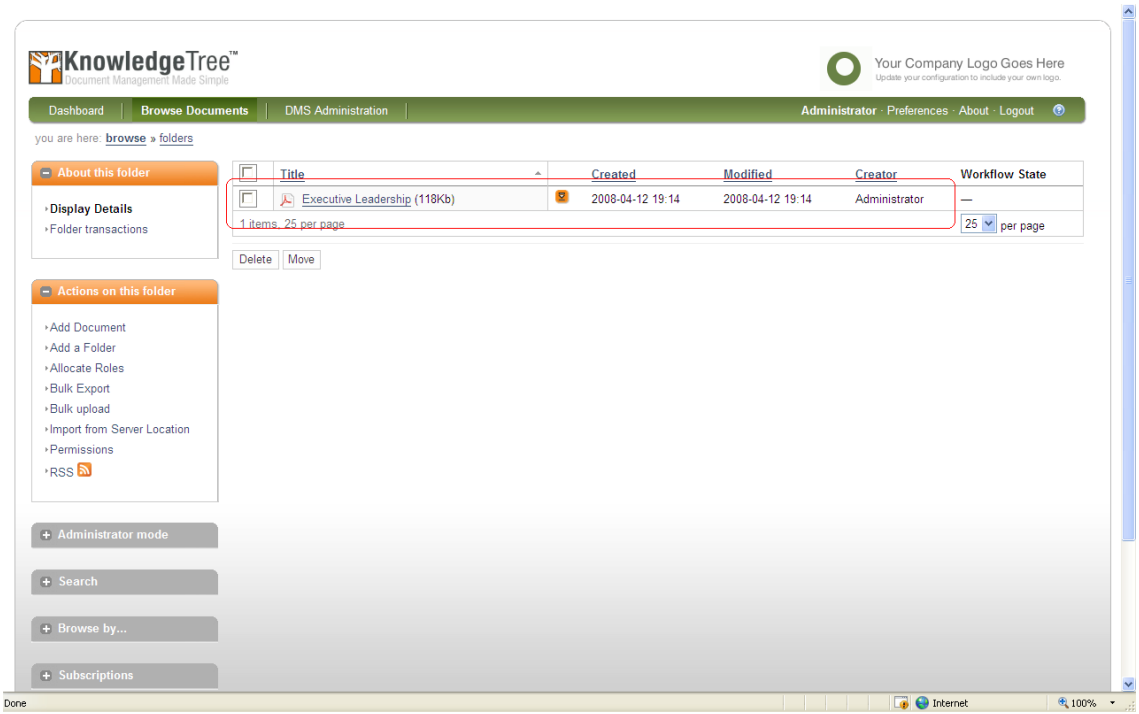

Figure 58: Screenshot of Deleting Documents in KnowledgeTree (5)

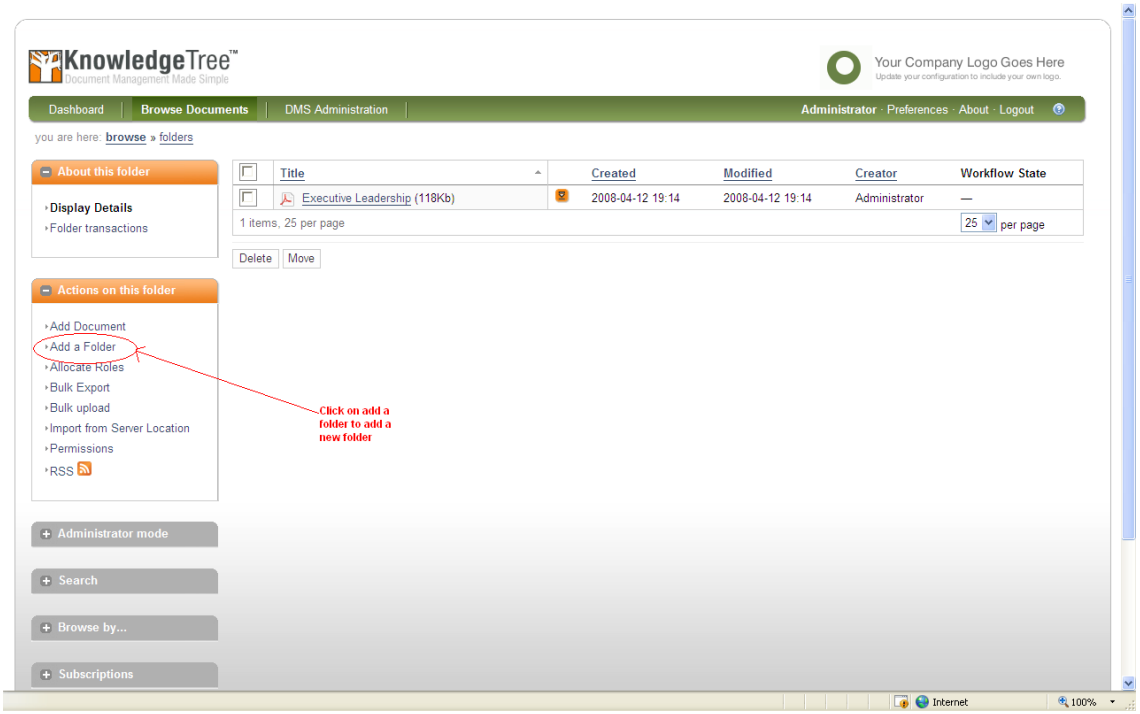

Figure 59: Screenshot of Adding a Folder in KnowledgeTree (1)

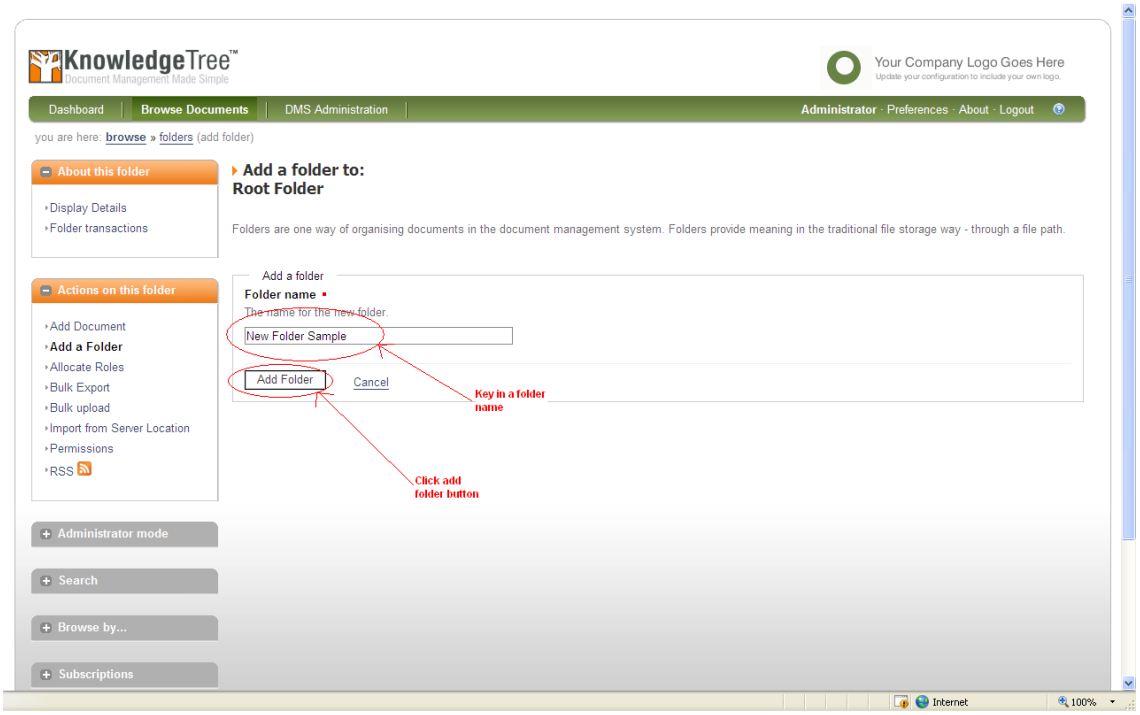

Figure 60: Screenshot of Adding a Folder in KnowledgeTree (2)

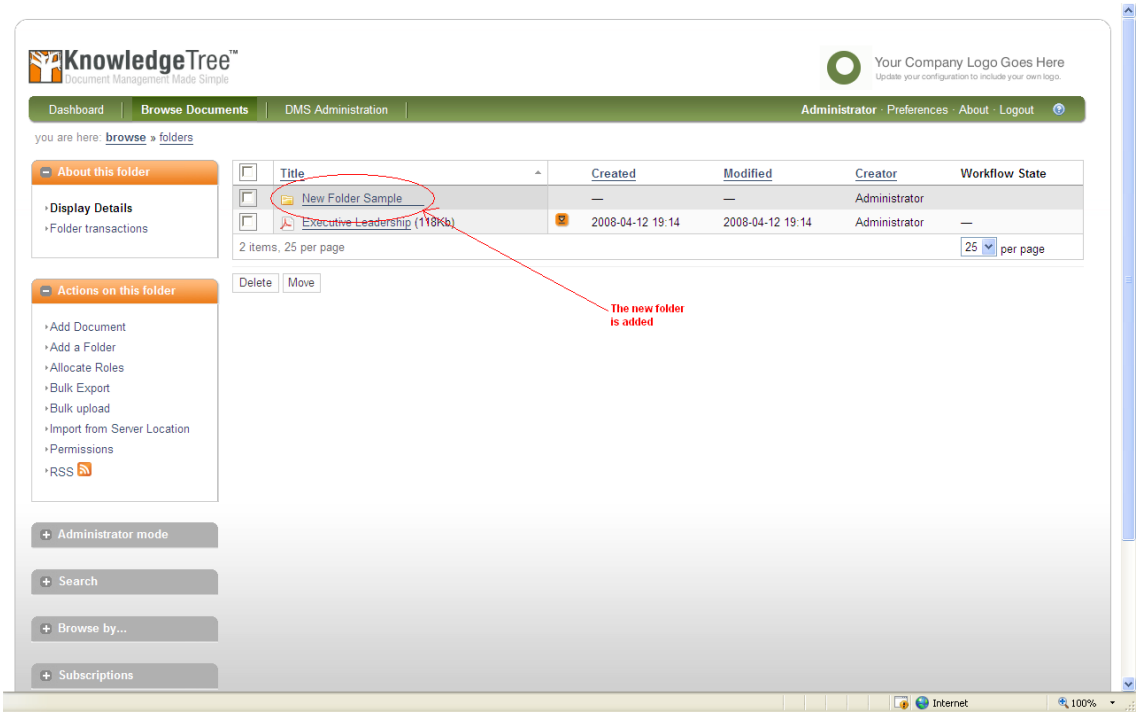

Figure 61: Screenshot of Adding a Folder in KnowledgeTree (3)

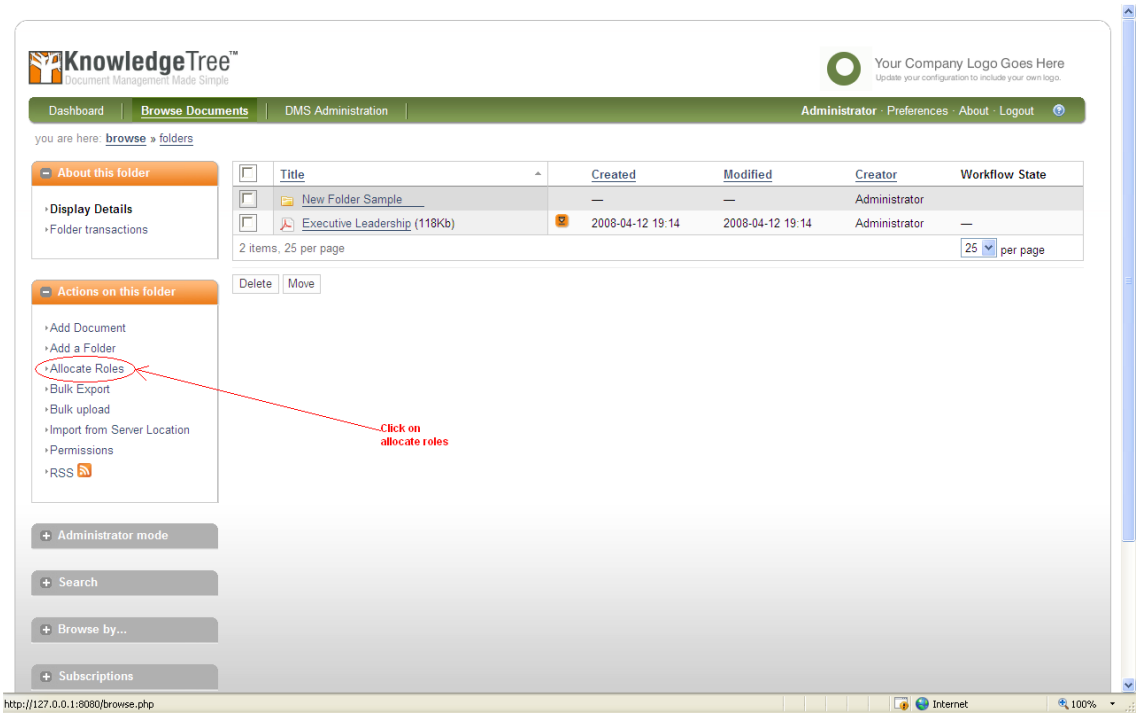

Figure 62: Screenshot of Allocating Roles in KnowledgeTree (1)

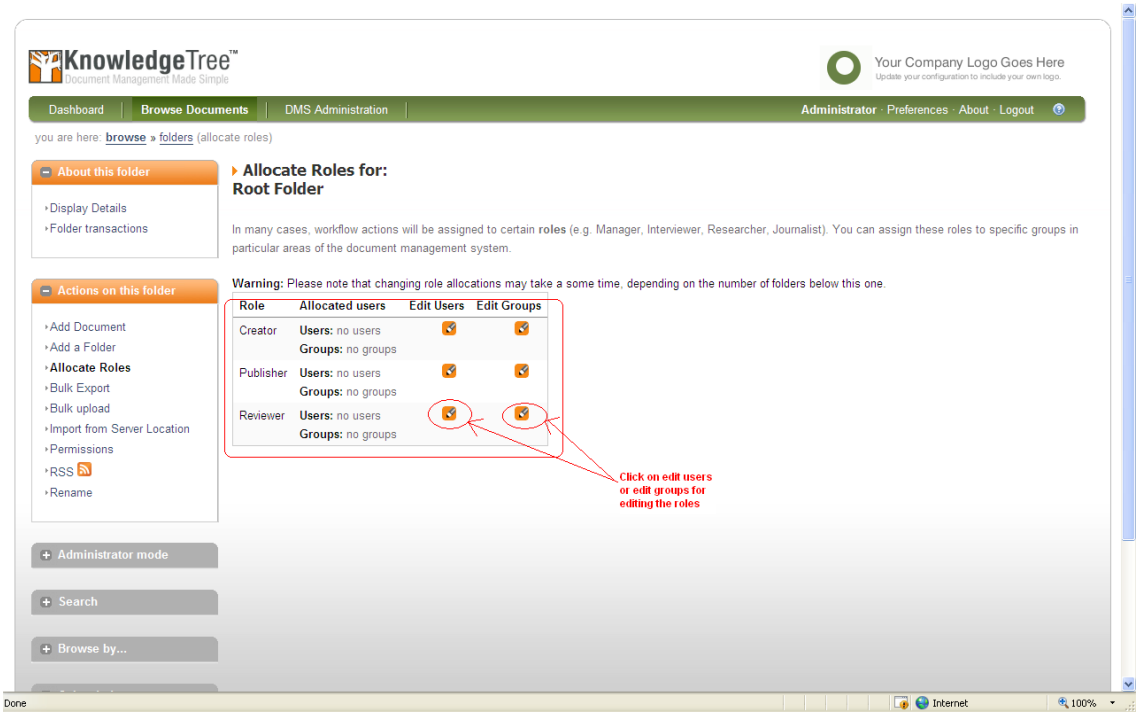

Figure 63: Screenshot of Allocating Roles in KnowledgeTree (2)

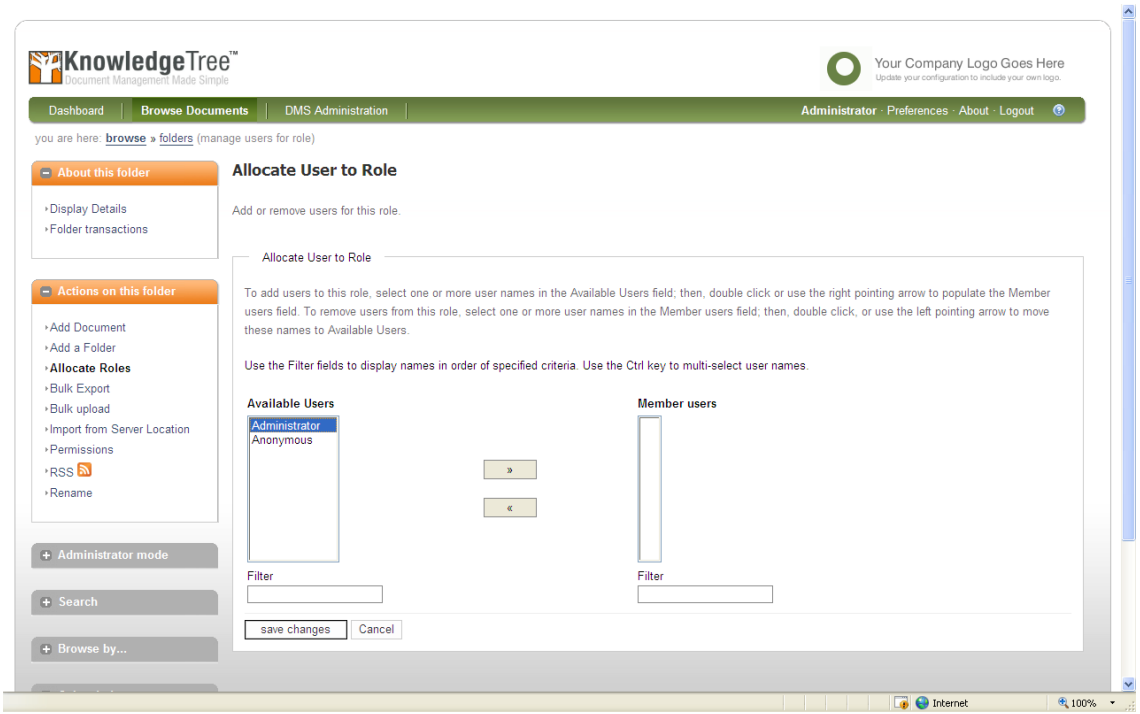

Figure 64: Screenshot of Allocating Roles in KnowledgeTree (3)

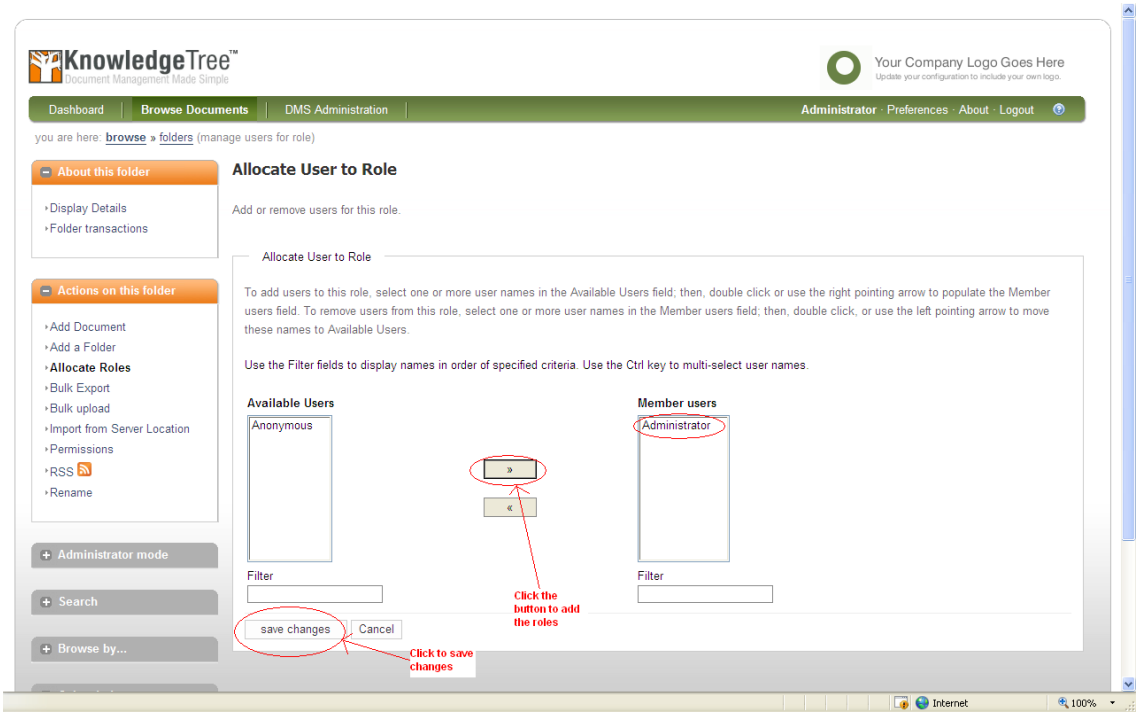

Figure 65: Screenshot of Allocating Roles in KnowledgeTree (4)

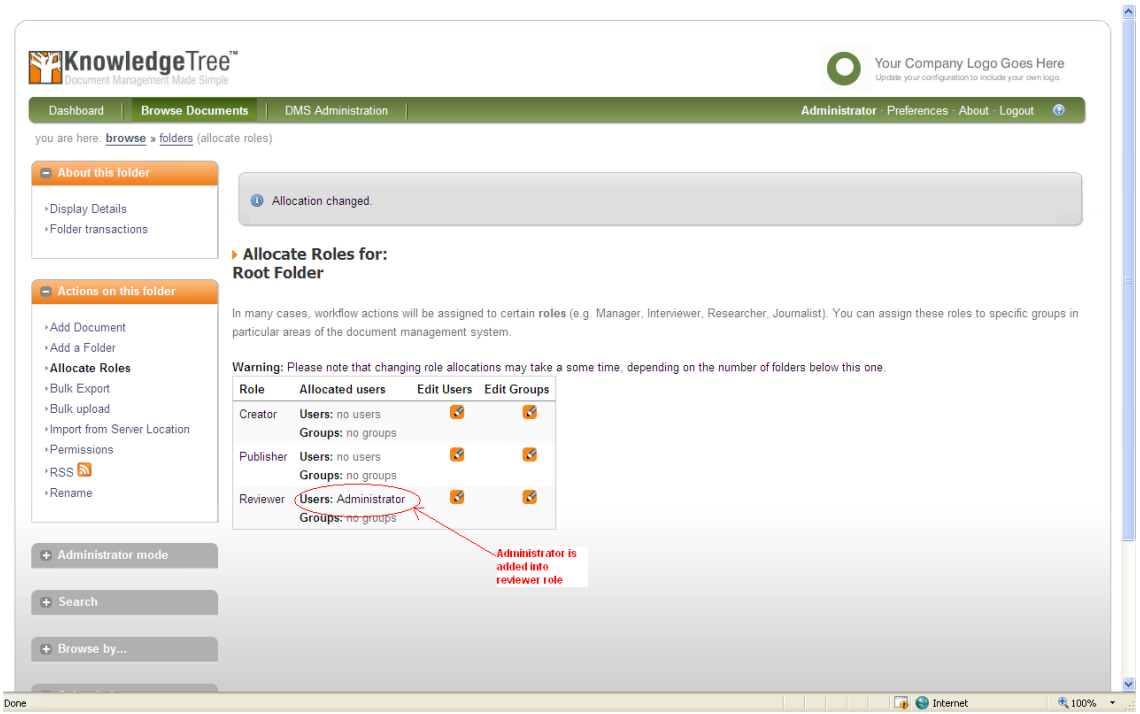

Figure 66: Screenshot of Allocating Roles in KnowledgeTree (5)

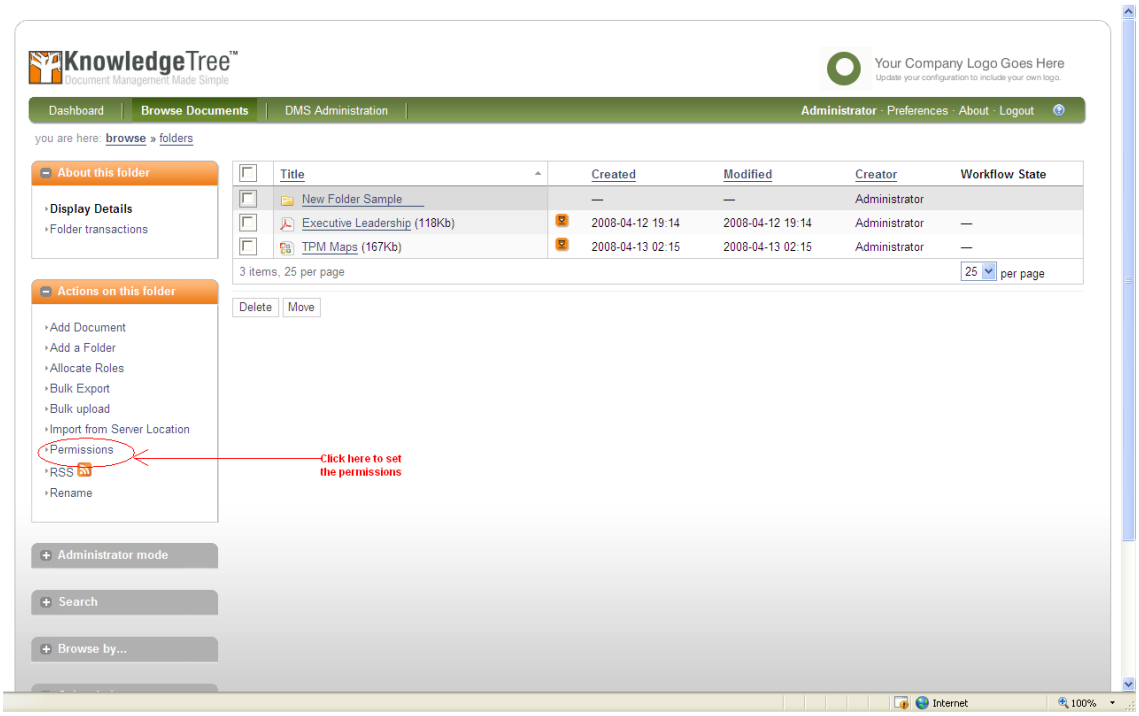

Figure 67: Screenshot of Allocating Permissions for Folder in KnowledgeTree (1)

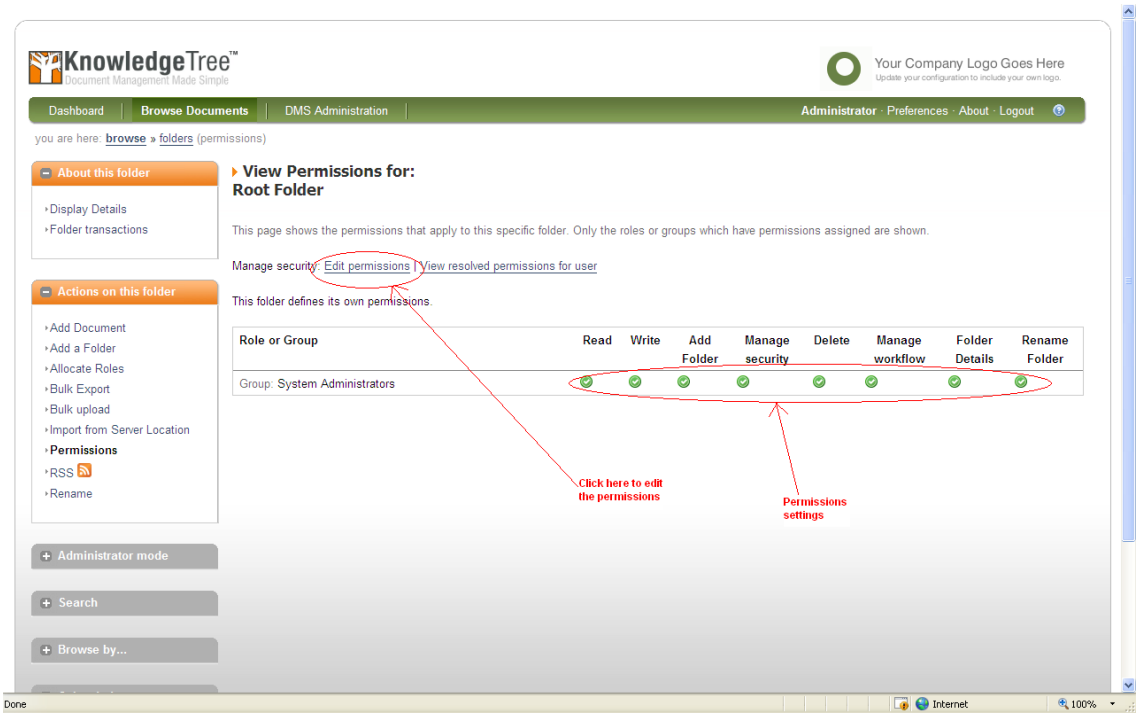

Figure 68: Screenshot of Allocating Permissions for Folder in KnowledgeTree (2)

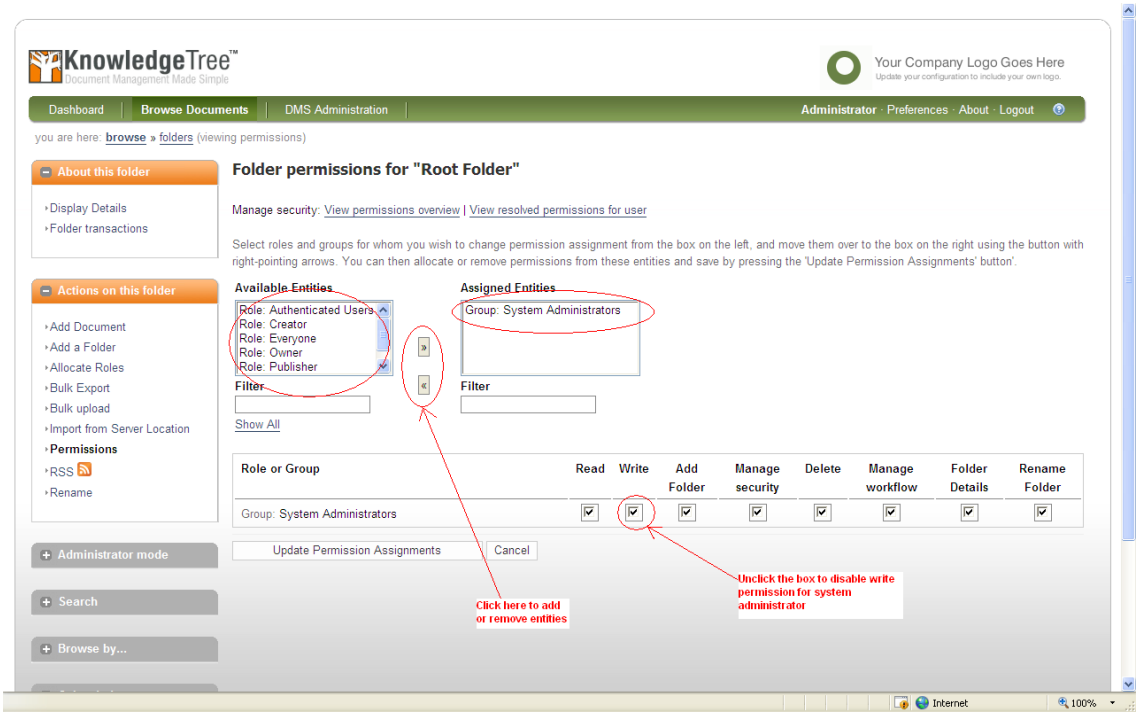

Figure 69: Screenshot of Allocating Permissions for Folder in KnowledgeTree (3)

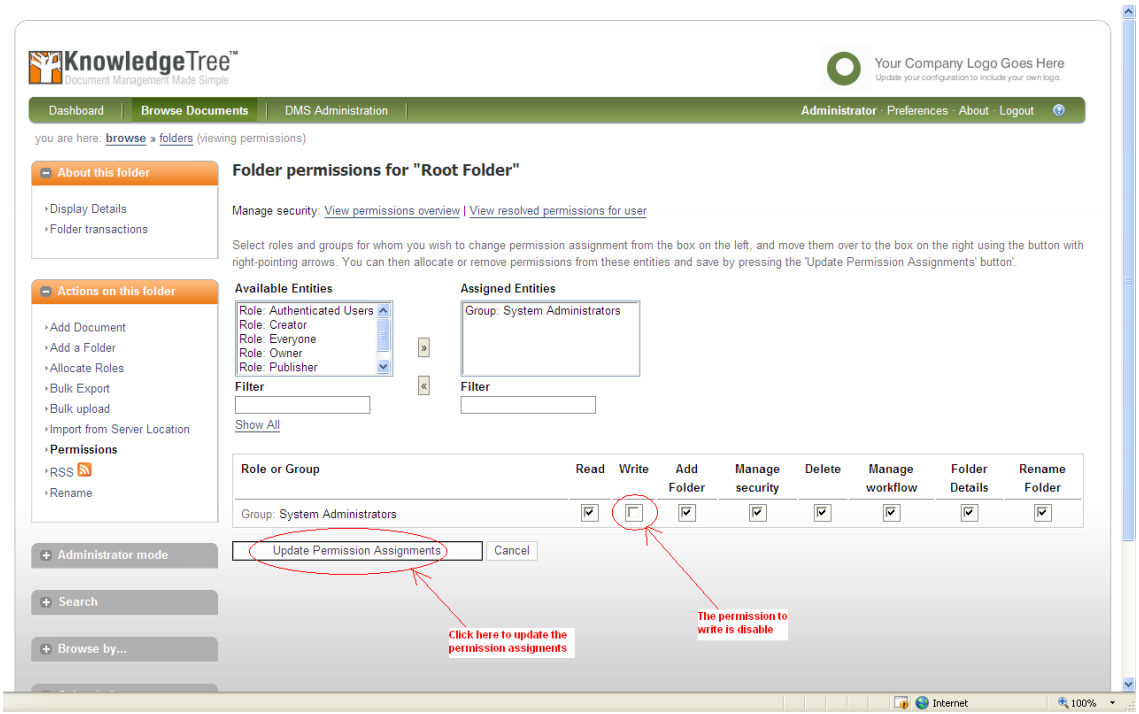

Figure 70: Screenshot of Allocating Permissions for Folder in KnowledgeTree (4)

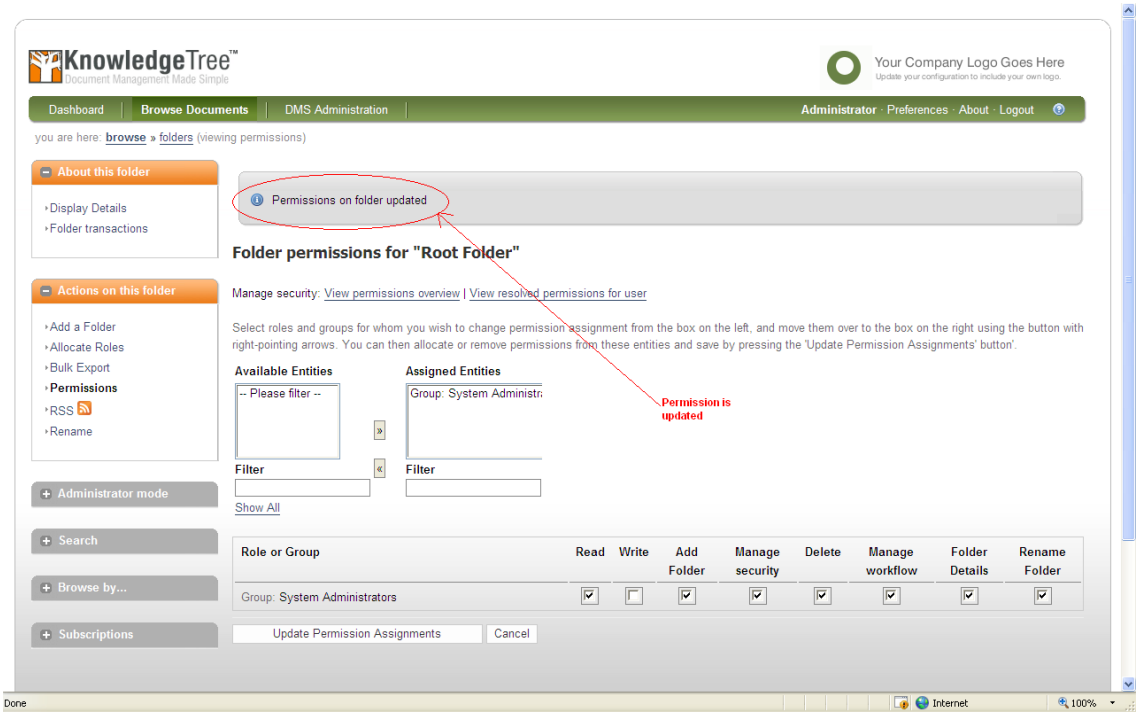

Figure 71: Screenshot of Allocating Permissions for Folder in KnowledgeTree (5)

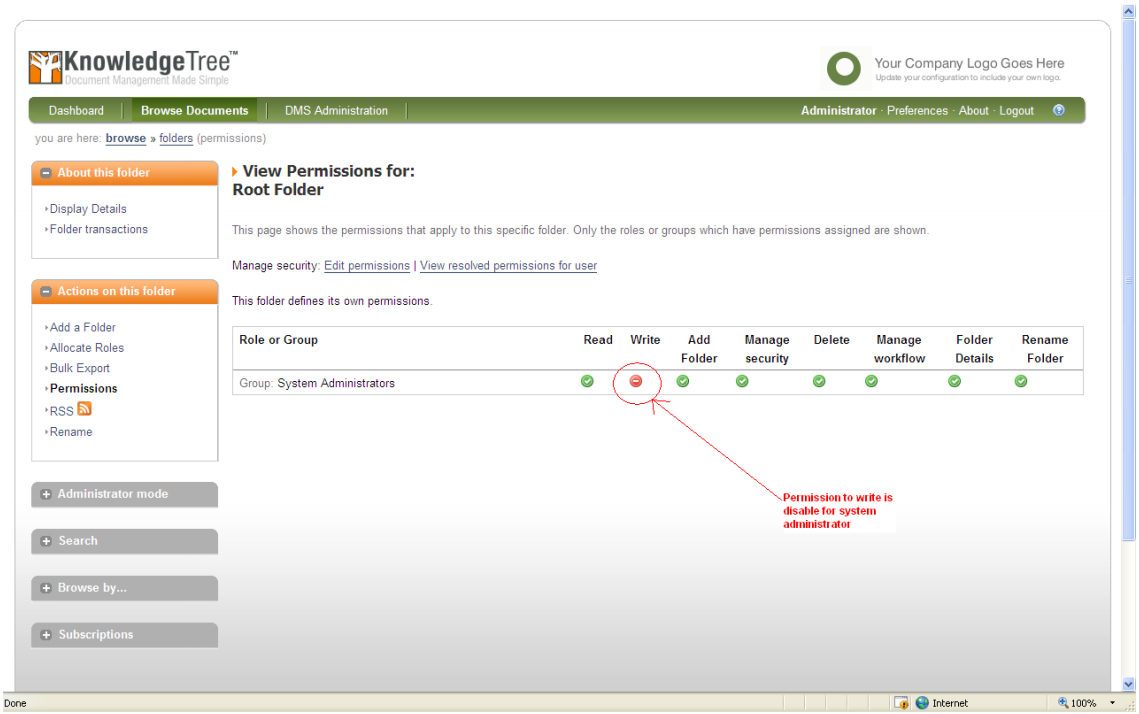

Figure 72: Screenshot of Allocating Permissions for Folder in KnowledgeTree (6)

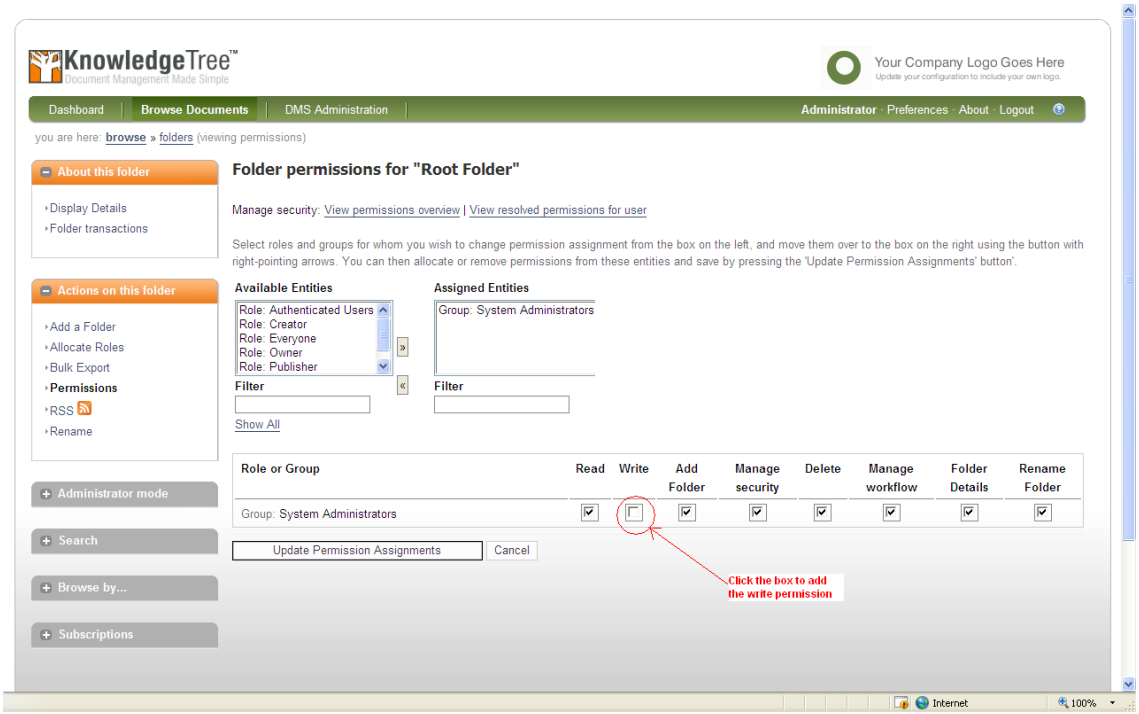

Figure 73: Screenshot of Allocating Permissions for Folder in KnowledgeTree (7)

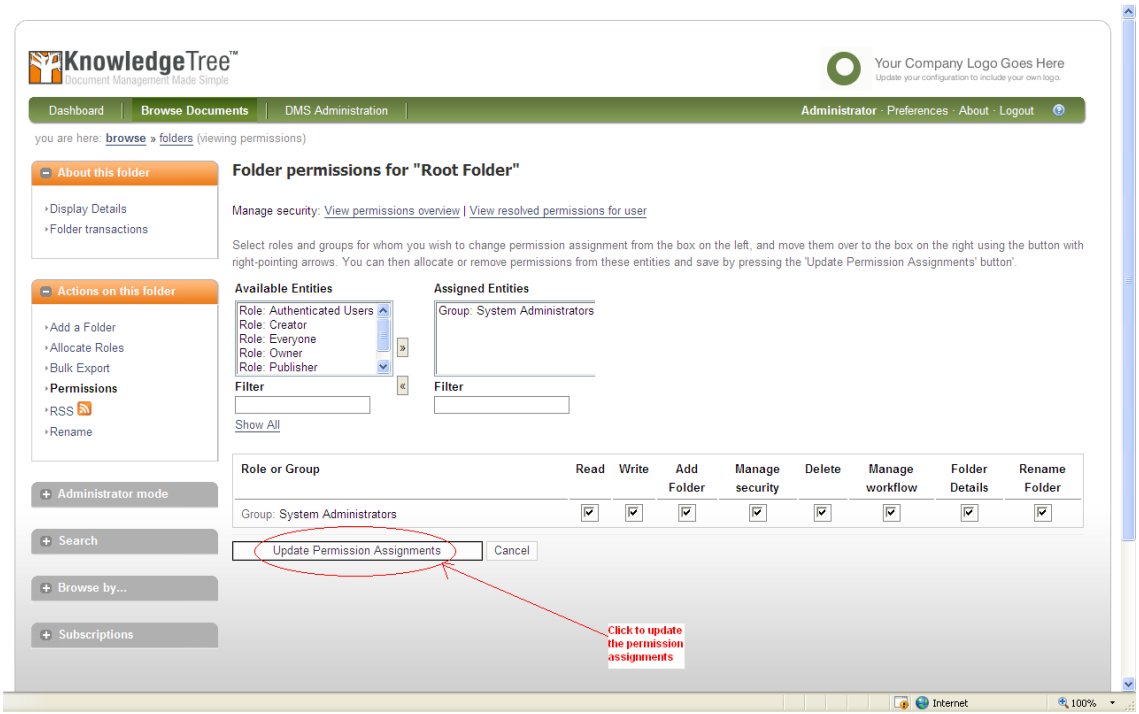

Figure 74: Screenshot of Allocating Permissions for Folder in KnowledgeTree (8)

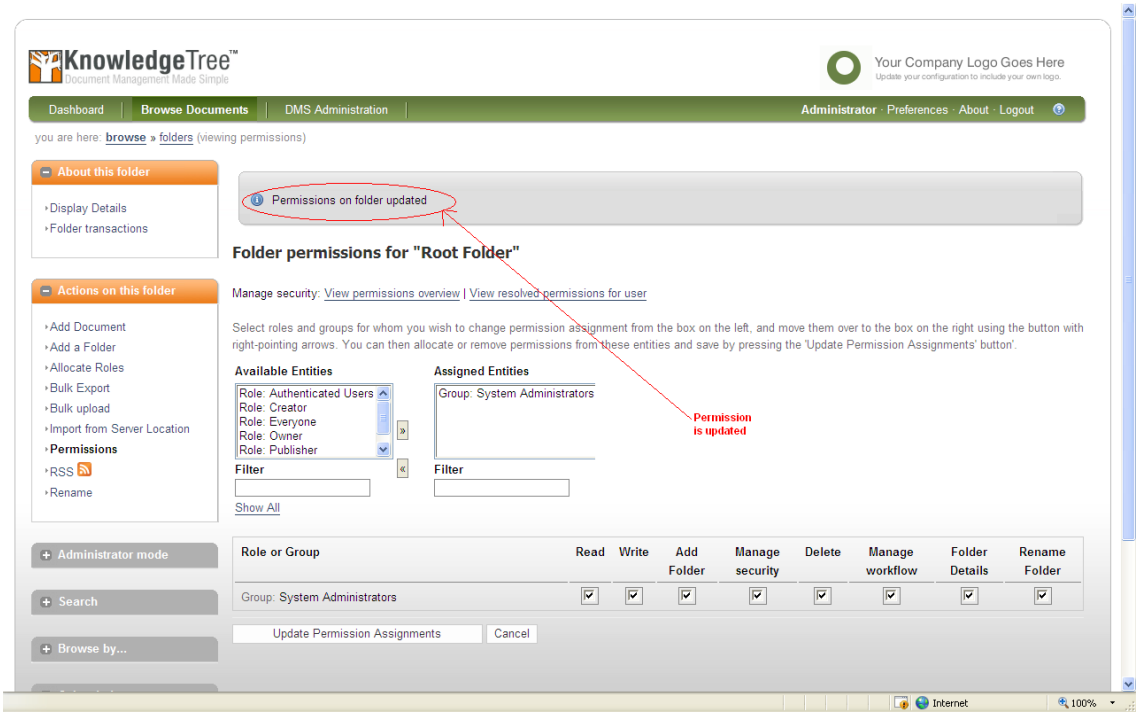

Figure 75: Screenshot of Allocating Permissions for Folder in KnowledgeTree (9)

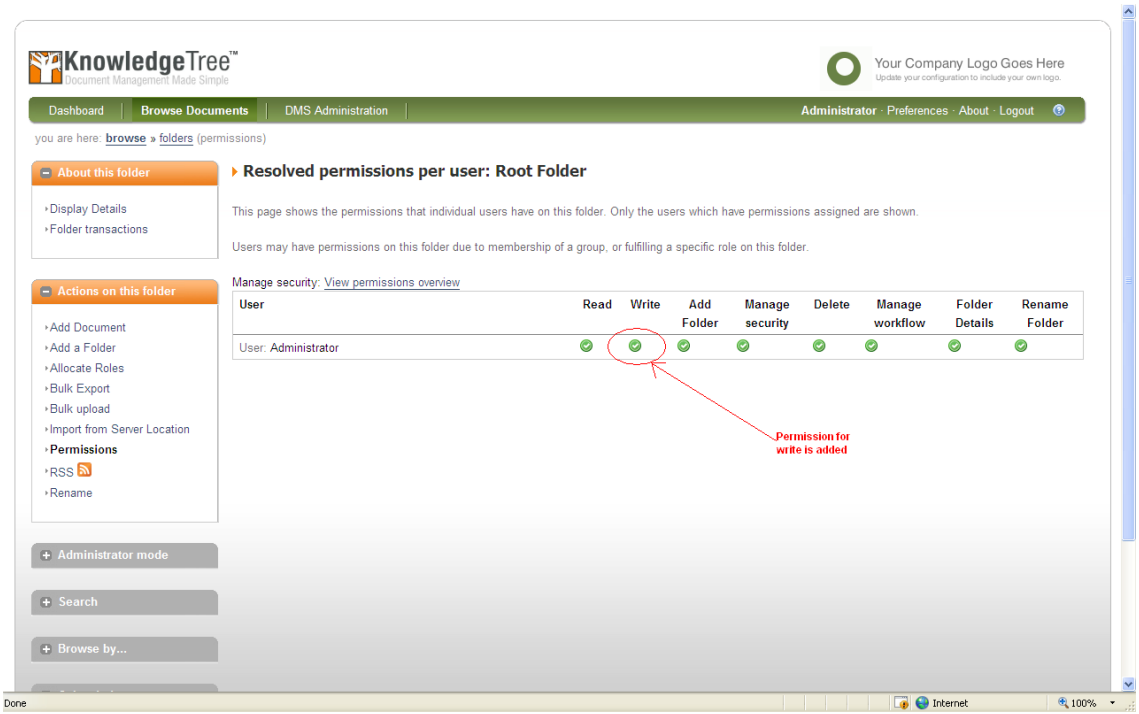

Figure 76: Screenshot of Allocating Permissions for Folder in KnowledgeTree (10)

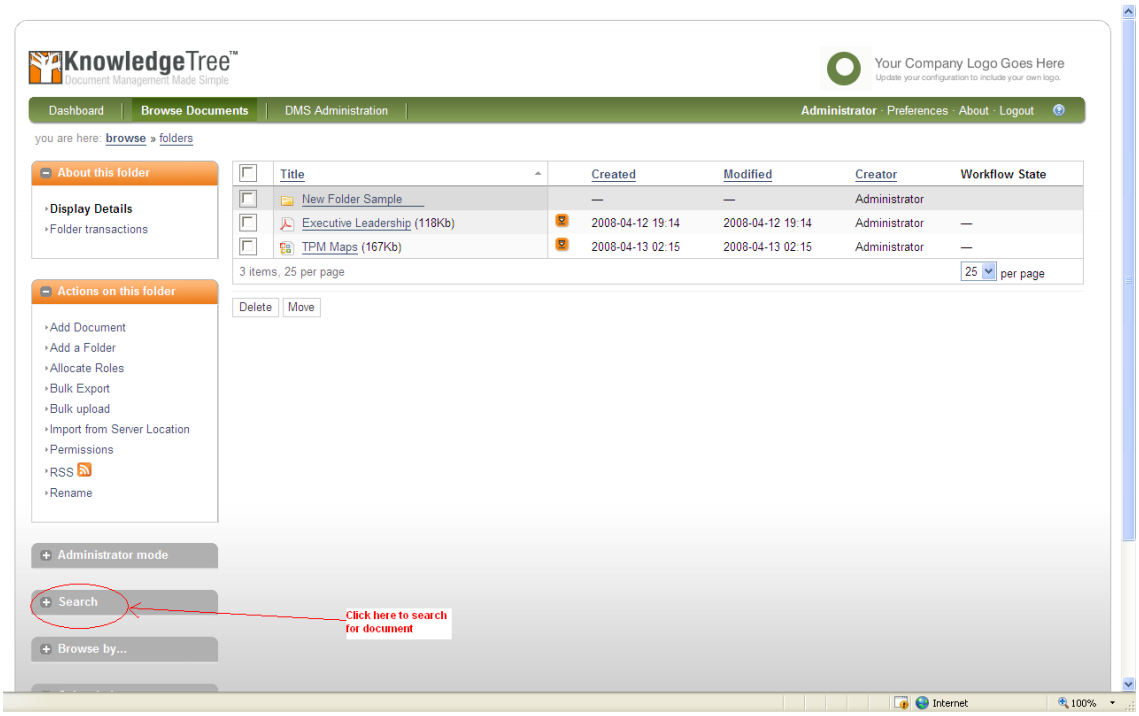

Figure 77: Screenshot of Search Functions in KnowledgeTree (1)

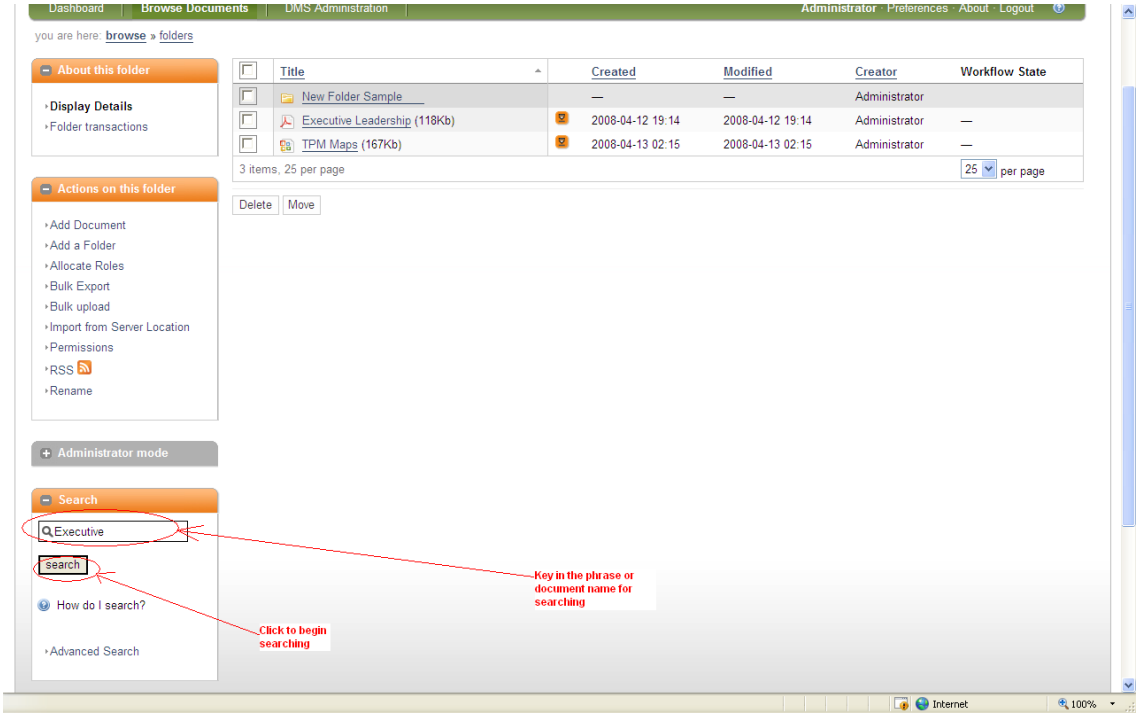

Figure 78: Screenshot of Search Functions in KnowledgeTree (2)

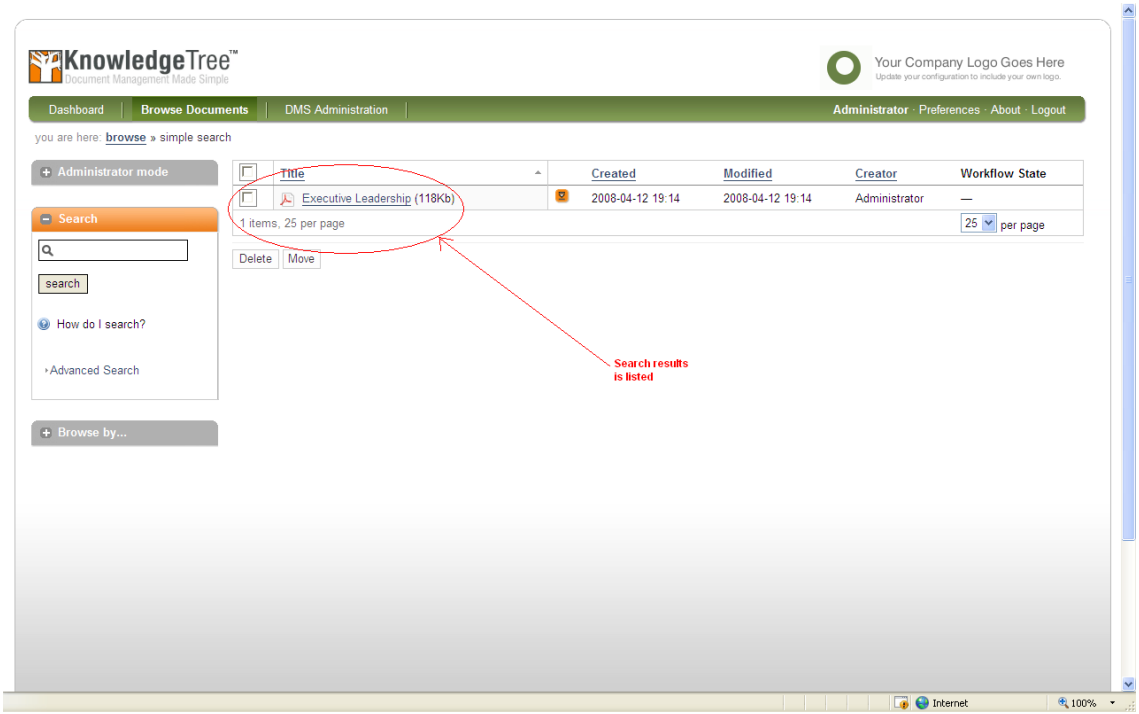

Figure 79: Screenshot of Search Functions in KnowledgeTree (3)

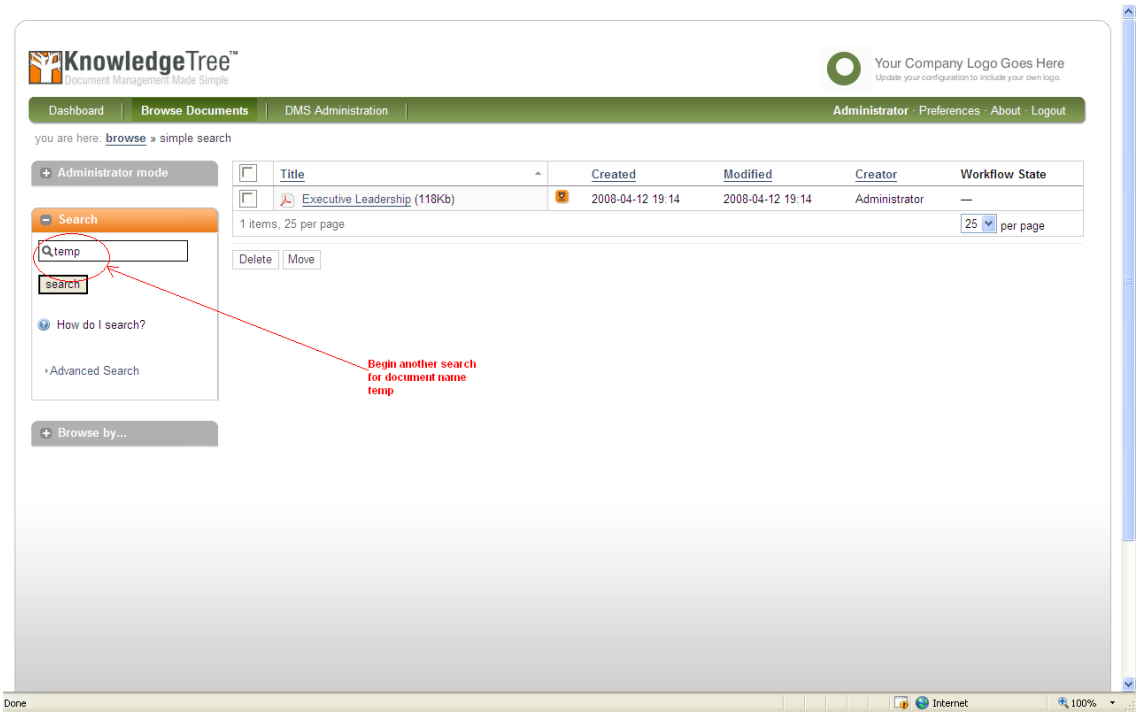

Figure 80: Screenshot of Search Functions in KnowledgeTree (4)

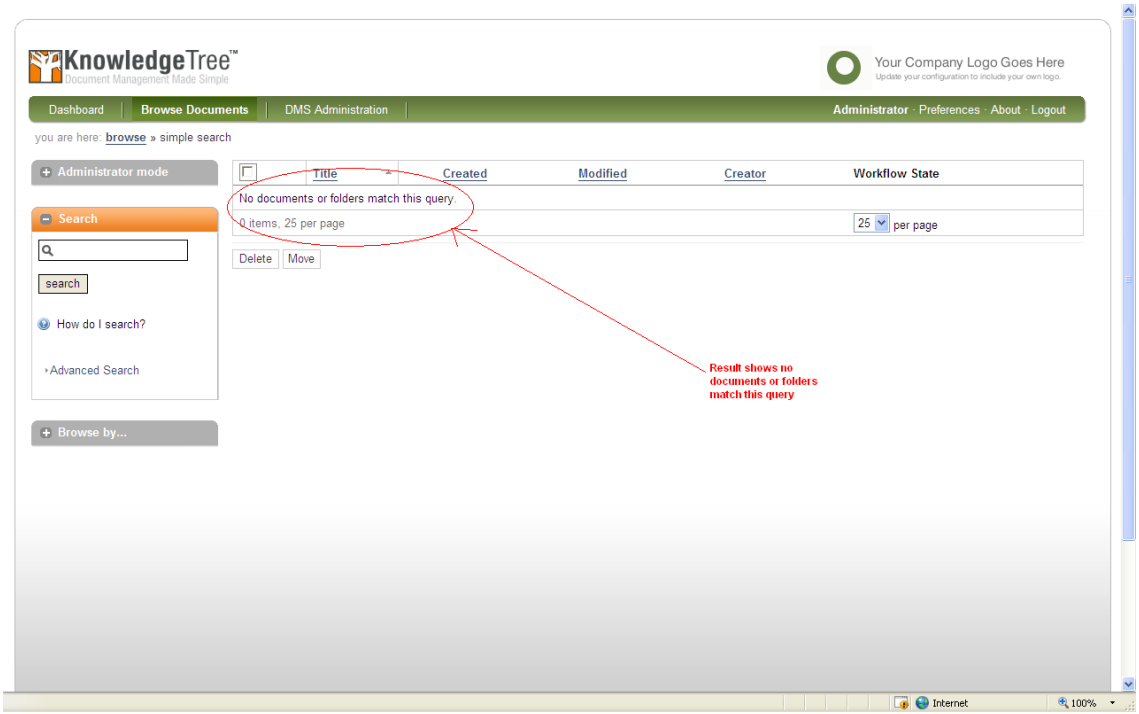

Figure 81: Screenshot of Search Functions in KnowledgeTree (5)

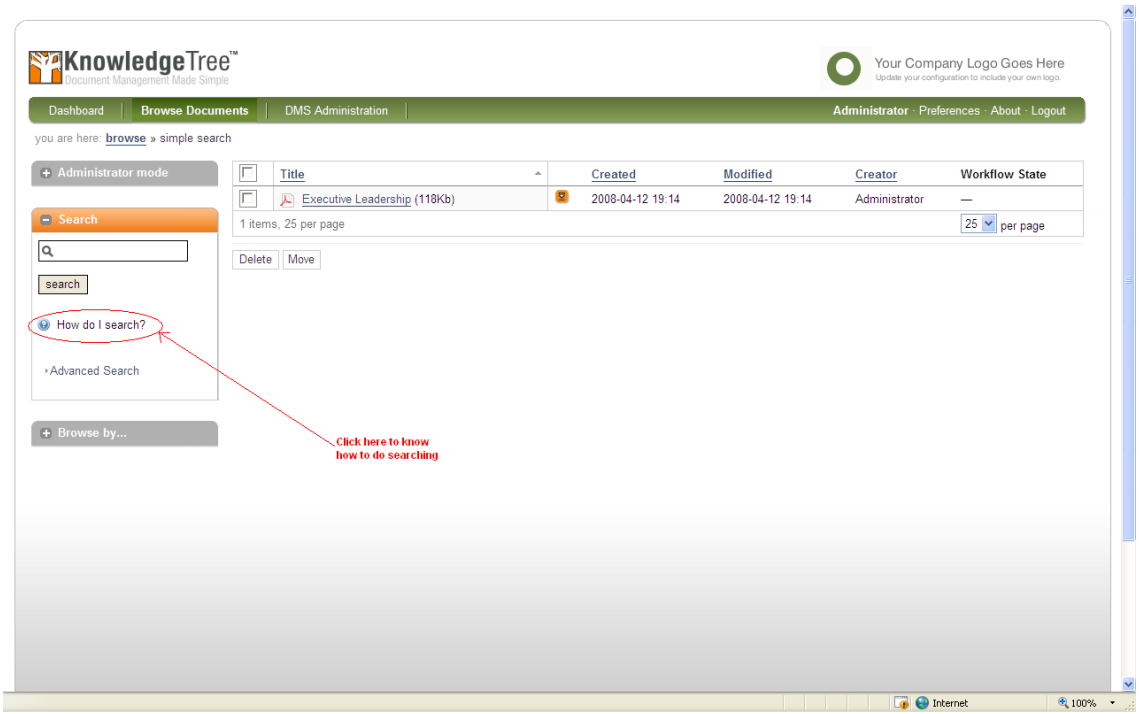

Figure 82: Screenshot of Search Functions in KnowledgeTree (6)

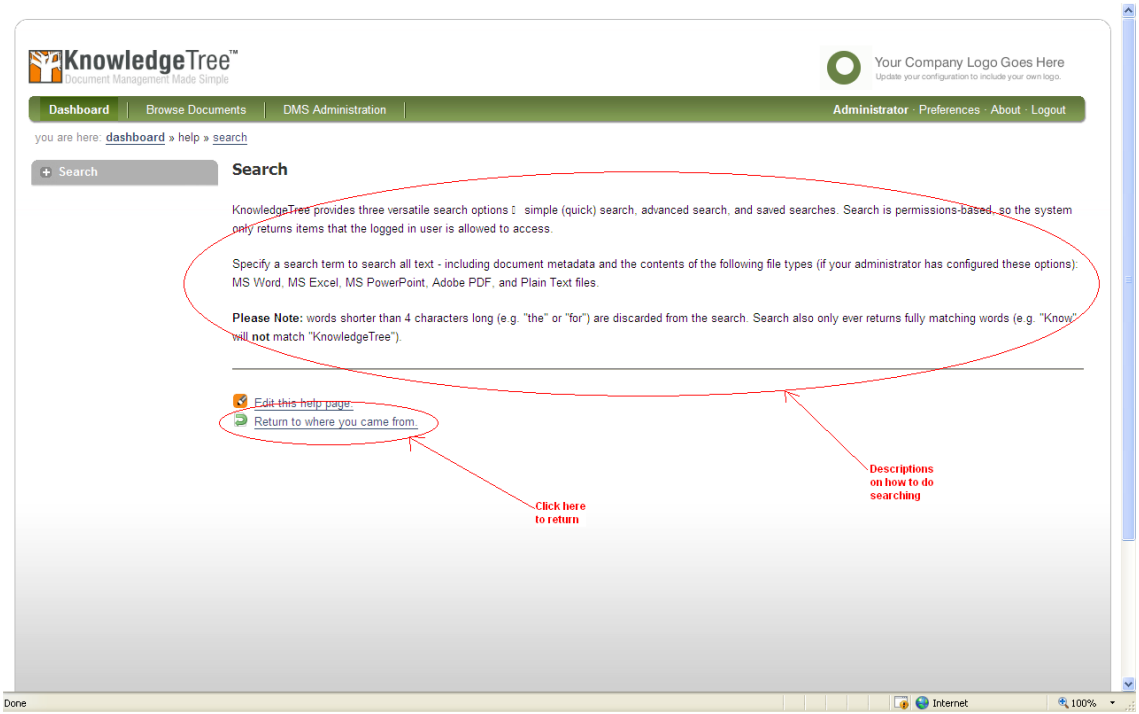

Figure 83: Screenshot of Search Functions in KnowledgeTree (7)

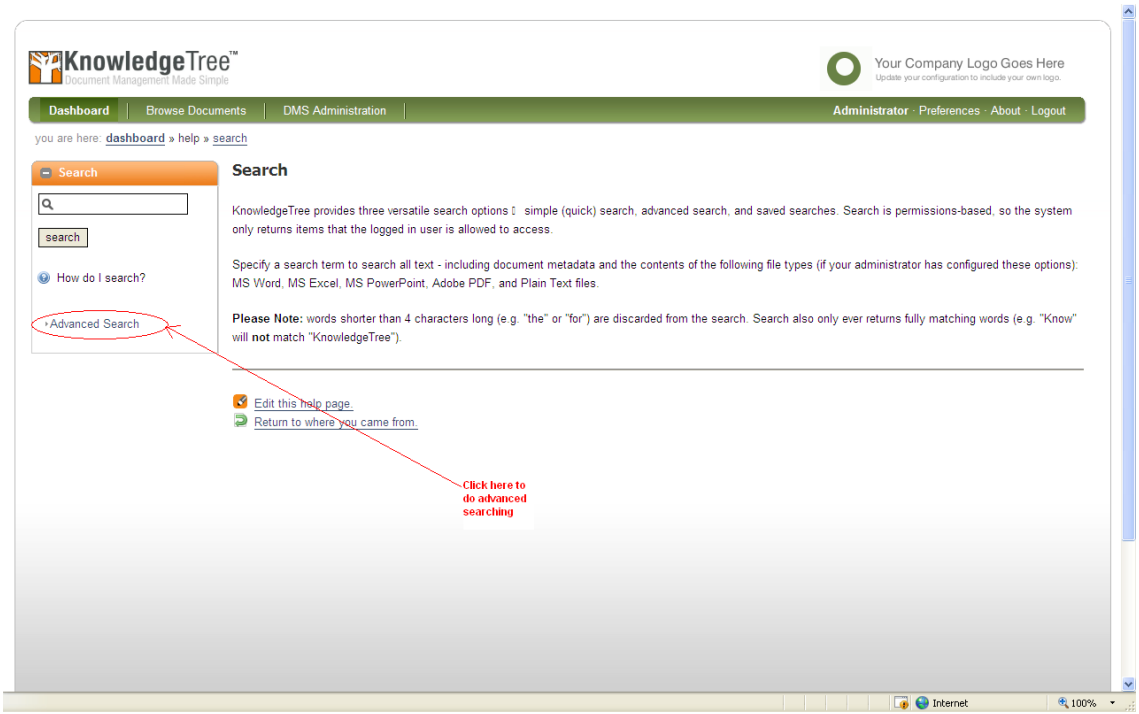

Figure 84: Screenshot of Search Functions in KnowledgeTree (8)

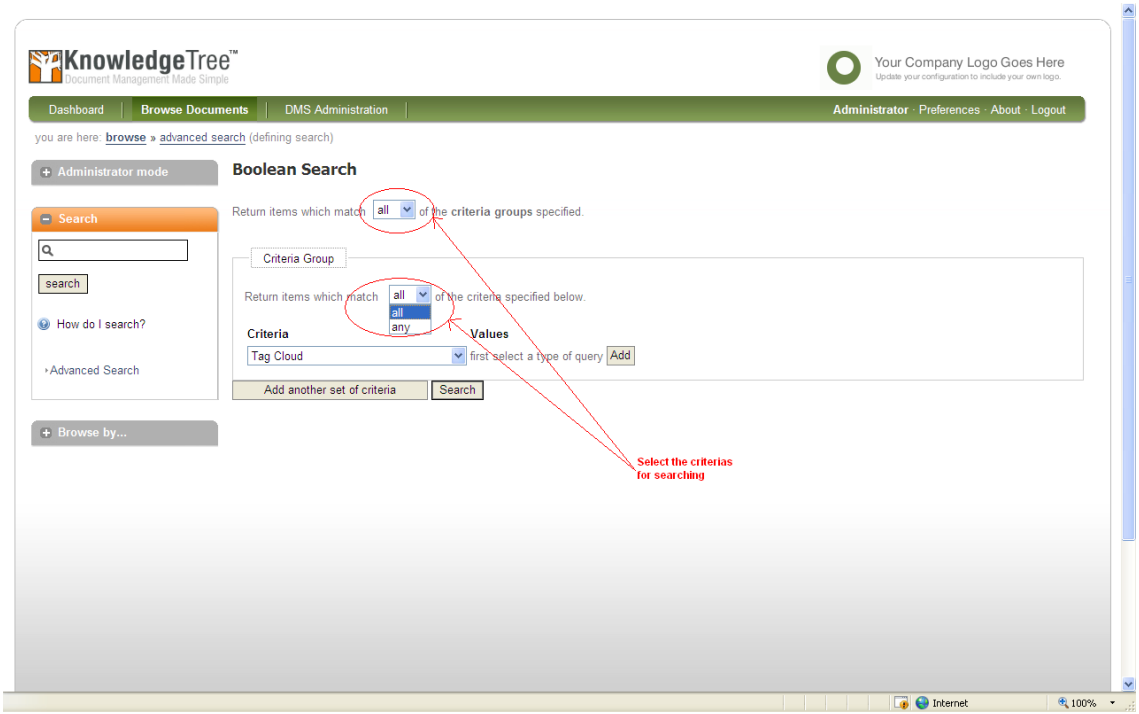

Figure 85: Screenshot of Search Functions in KnowledgeTree (9)

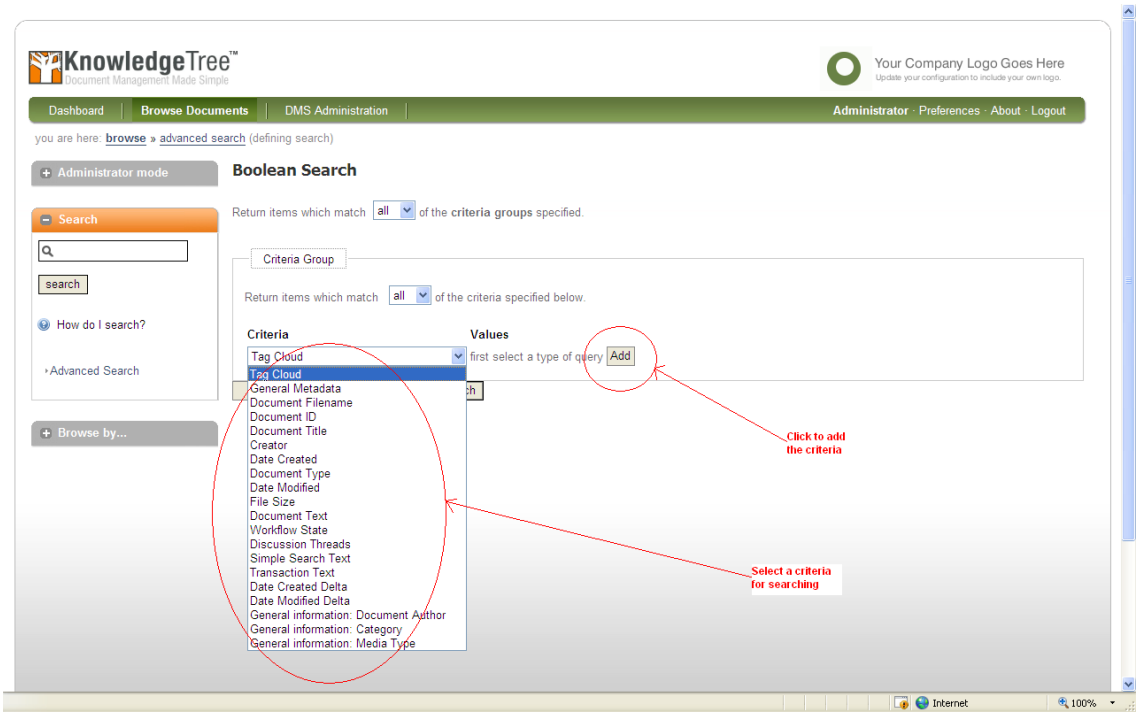

Figure 86: Screenshot of Search Functions in KnowledgeTree (10)

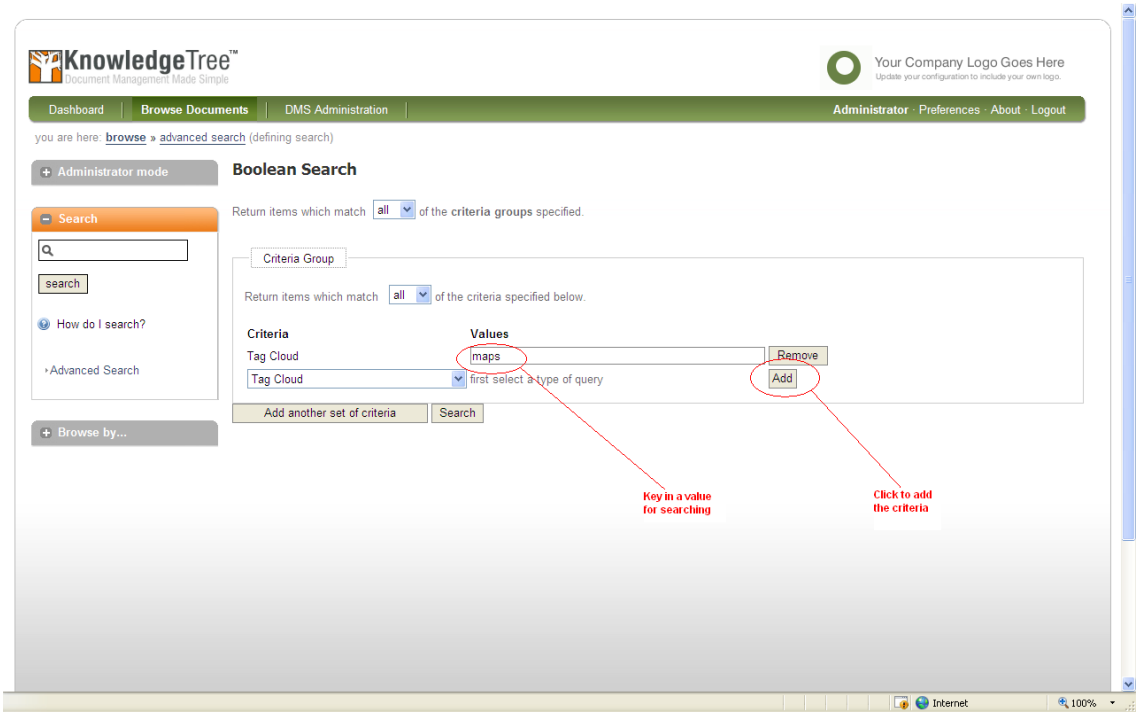

Figure 87: Screenshot of Search Functions in KnowledgeTree (11)

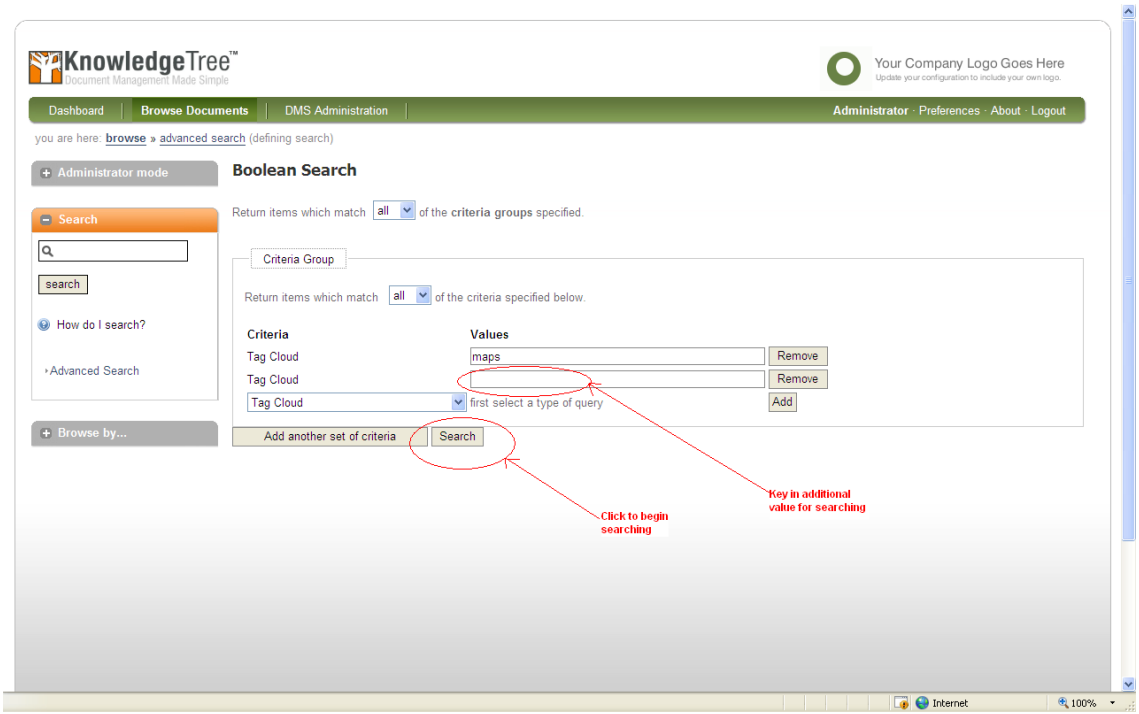

Figure 88: Screenshot of Search Functions in KnowledgeTree (12)

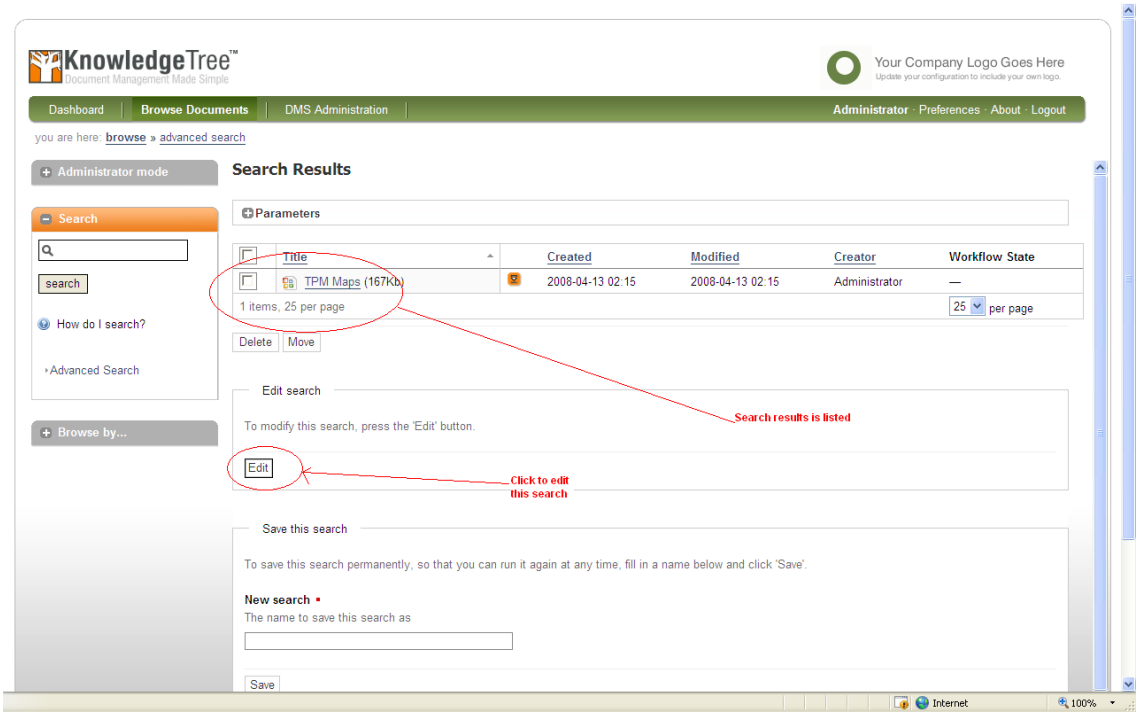

Figure 89: Screenshot of Search Functions in KnowledgeTree (13)

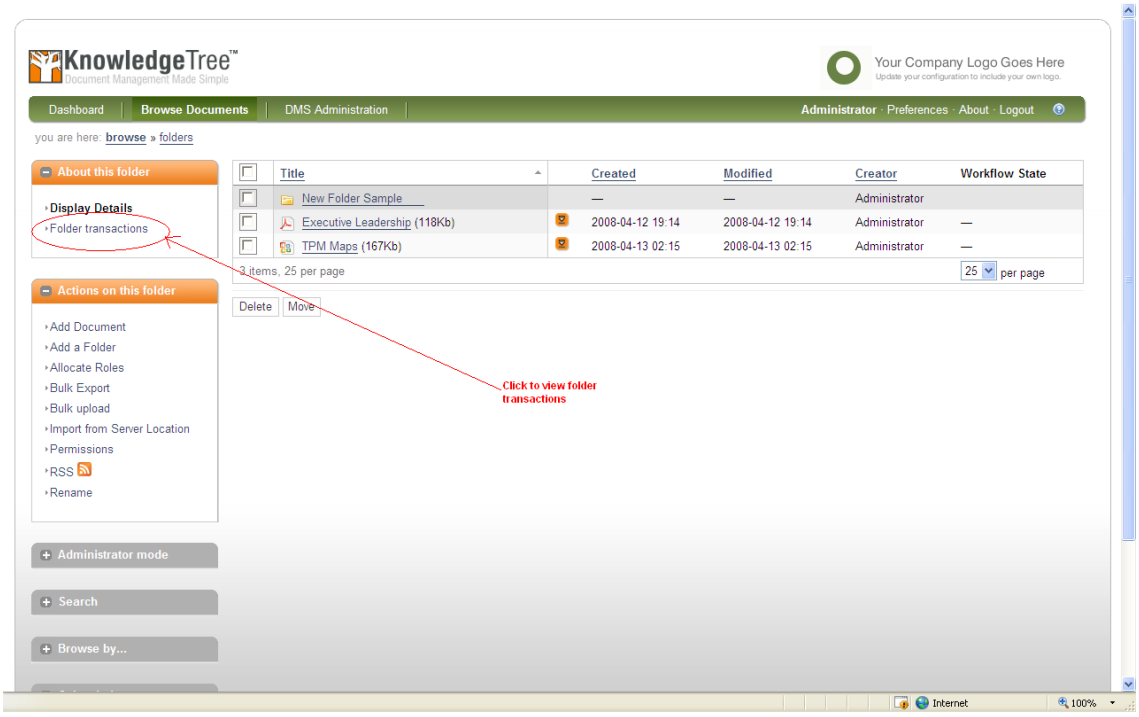

Figure 90: Screenshot of Folder Transactions in KnowledgeTree (1)

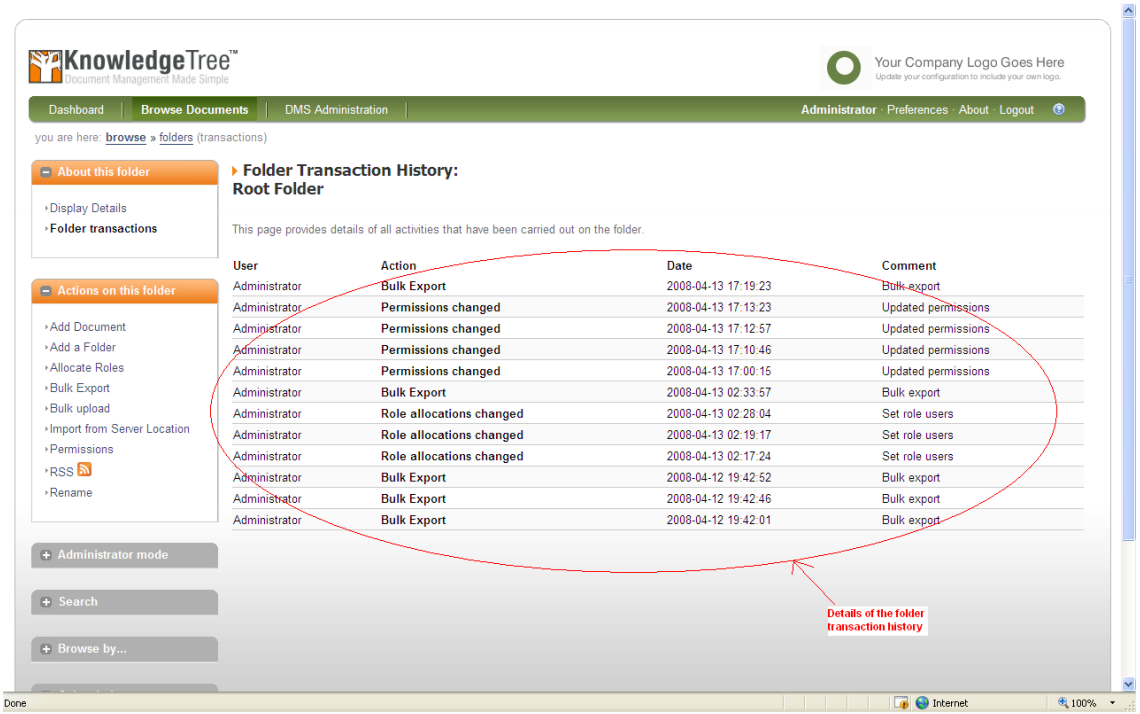

Figure 91: Screenshot of Folder Transactions in KnowledgeTree (2)

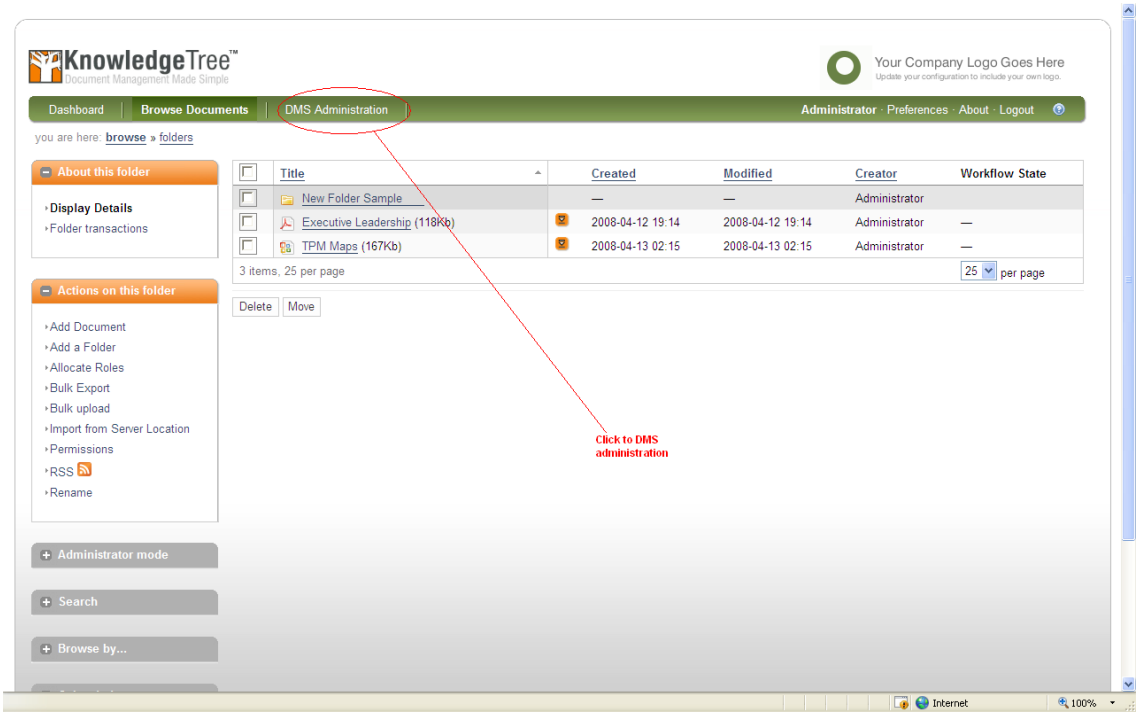

Figure 92: Screenshot of Users and Groups Management in KnowledgeTree (1)

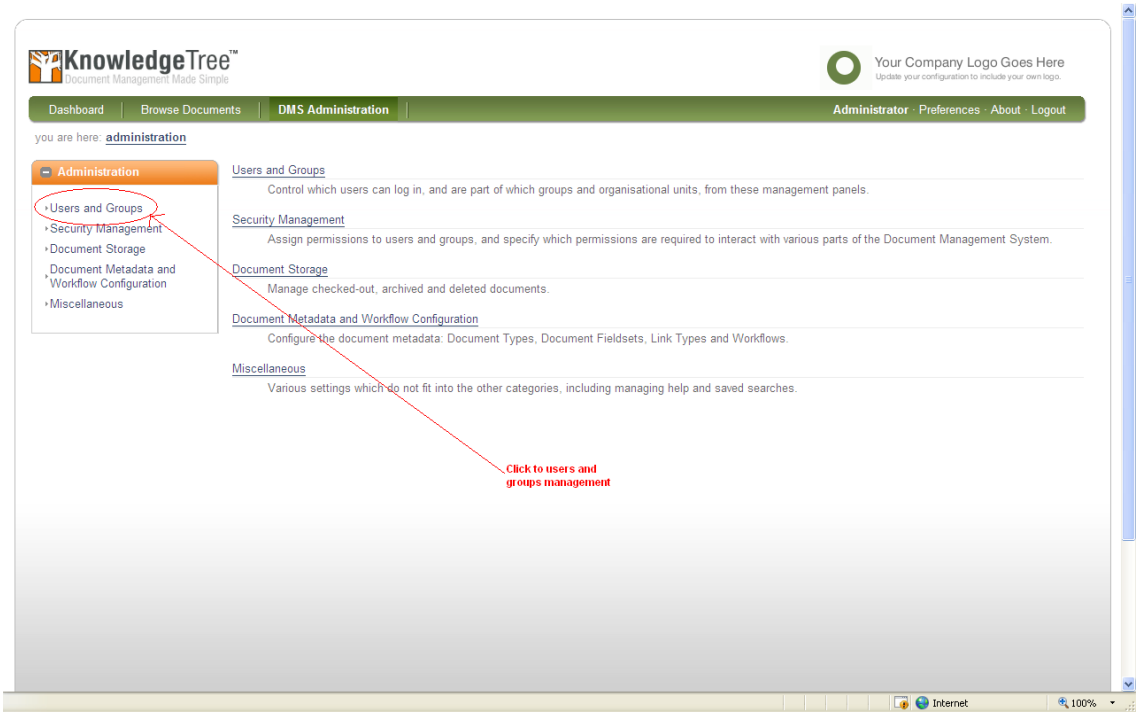

Figure 93: Screenshot of Users and Groups Management in KnowledgeTree (2)

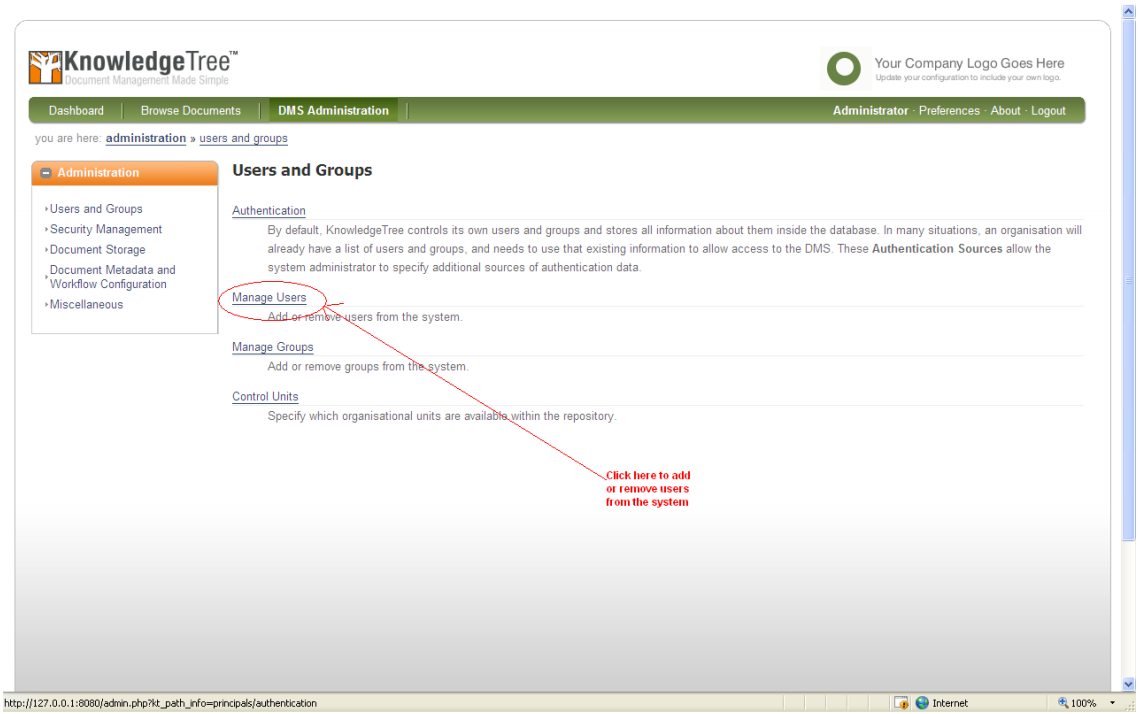

Figure 94: Screenshot of Users and Groups Management in KnowledgeTree (3)

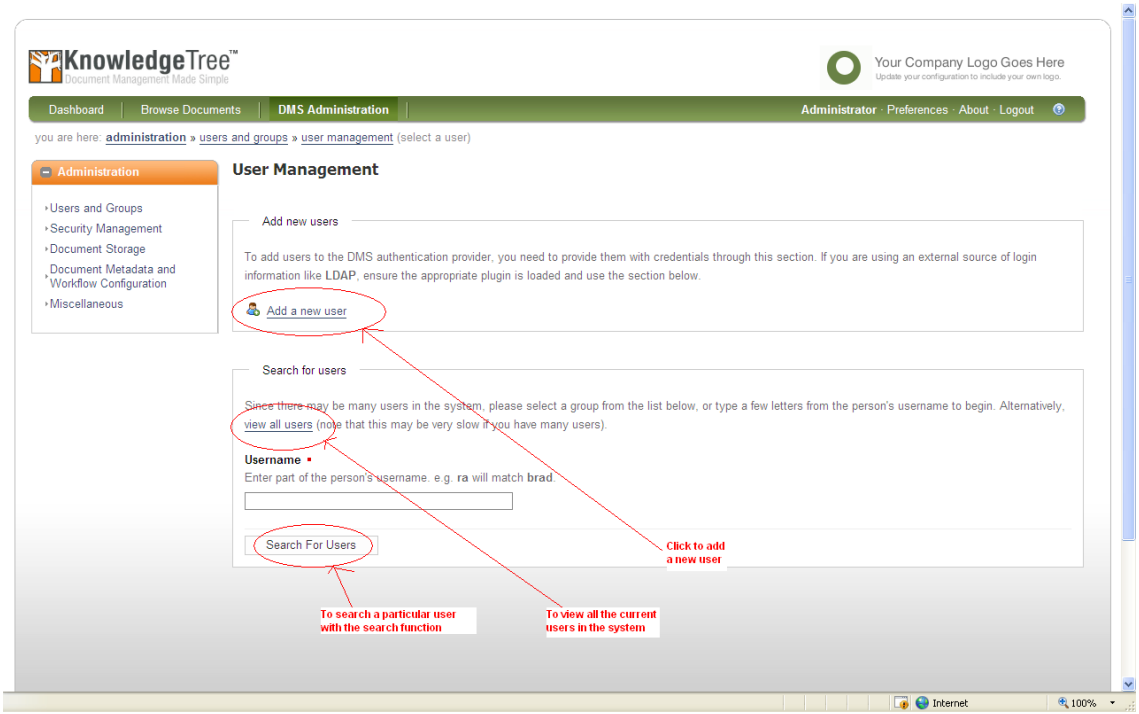

Figure 95: Screenshot of Users and Groups Management in KnowledgeTree (4)

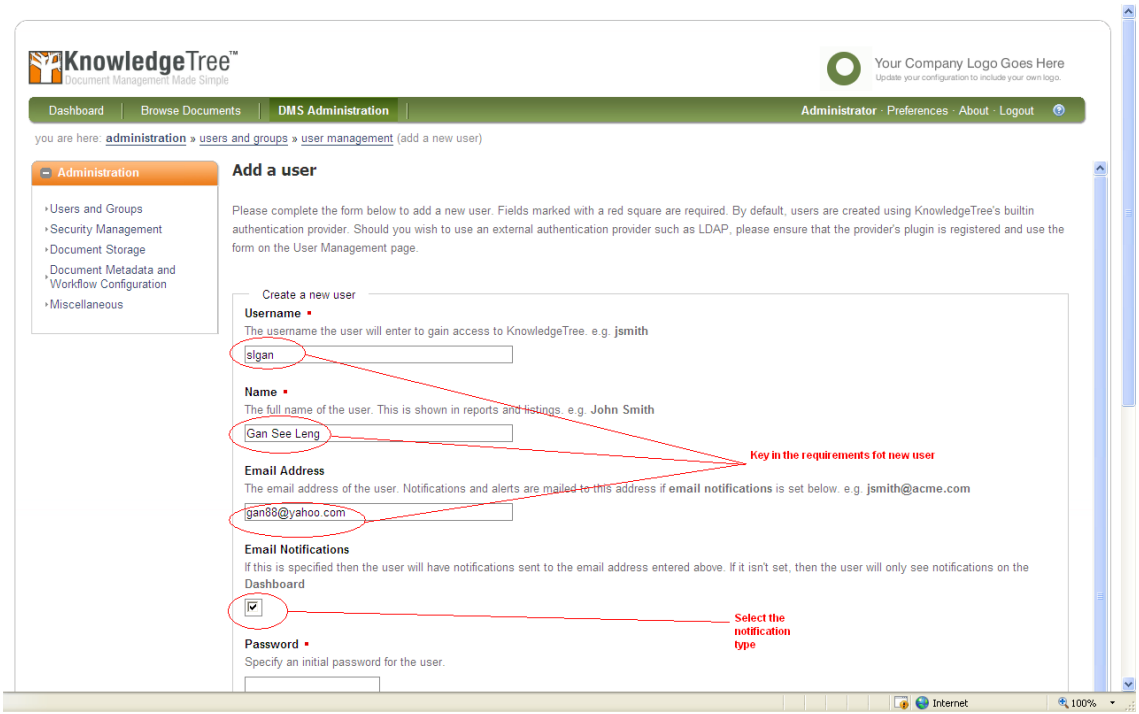

Figure 96: Screenshot of Users and Groups Management in KnowledgeTree (5)

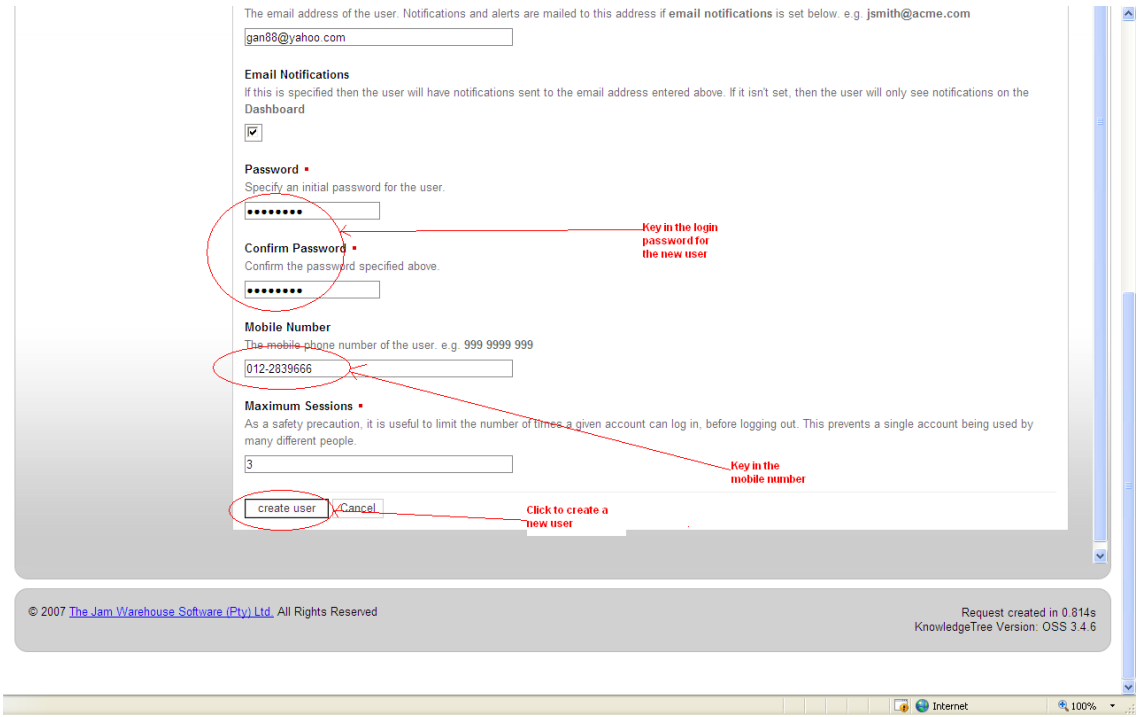

Figure 97: Screenshot of Users and Groups Management in KnowledgeTree (6)

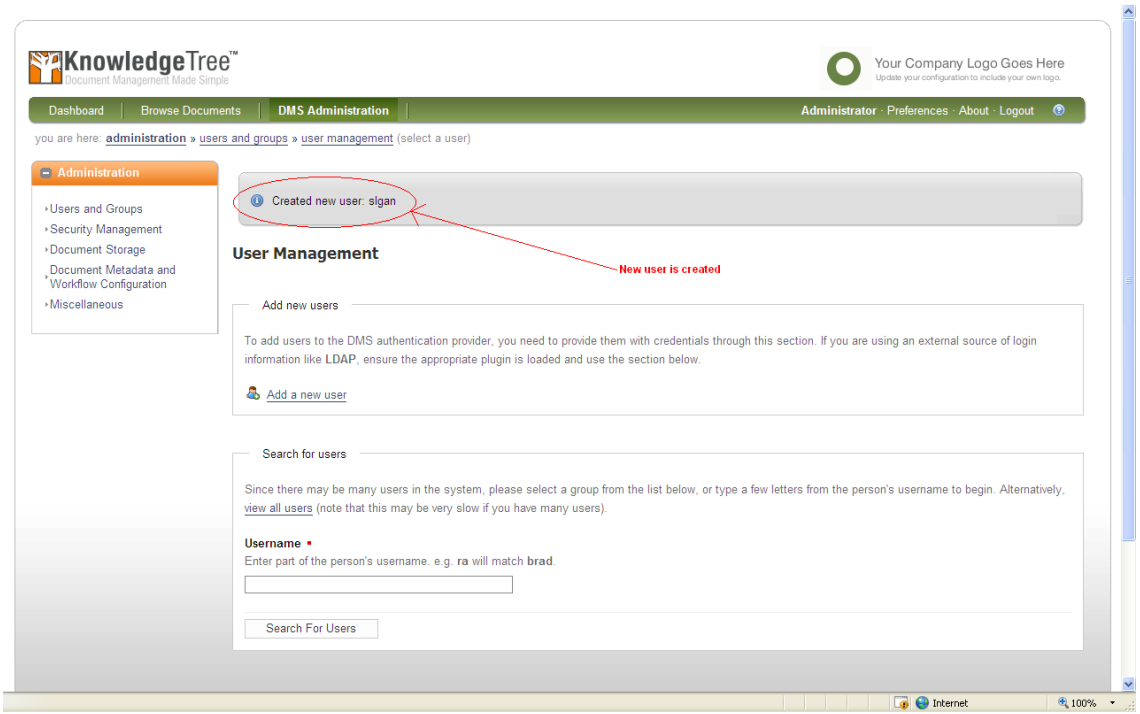

Figure 98: Screenshot of Users and Groups Management in KnowledgeTree (7)

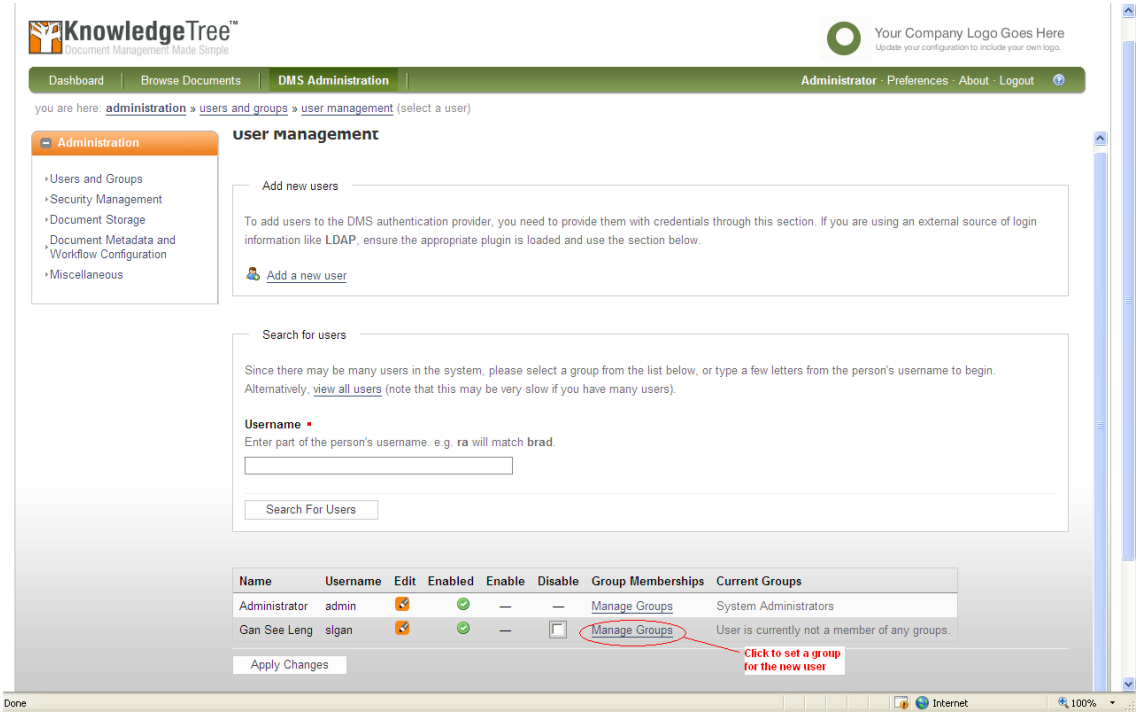

Figure 99: Screenshot of Users and Groups Management in KnowledgeTree (8)

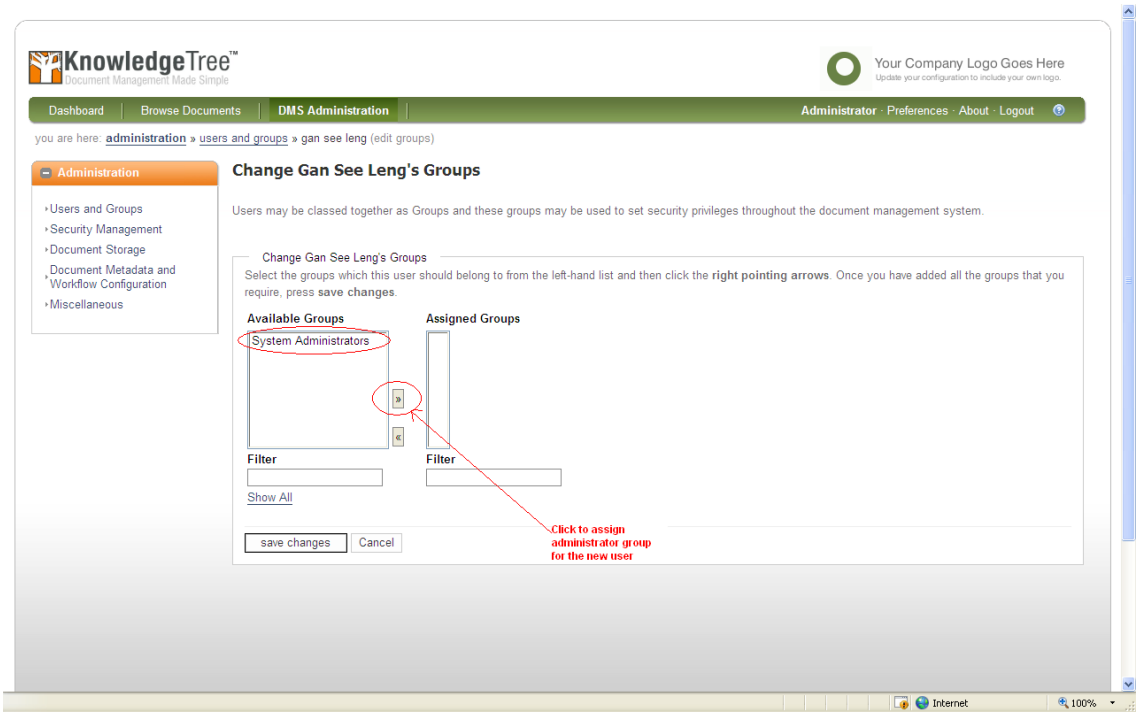

Figure 100: Screenshot of Users and Groups Management in KnowledgeTree (9)

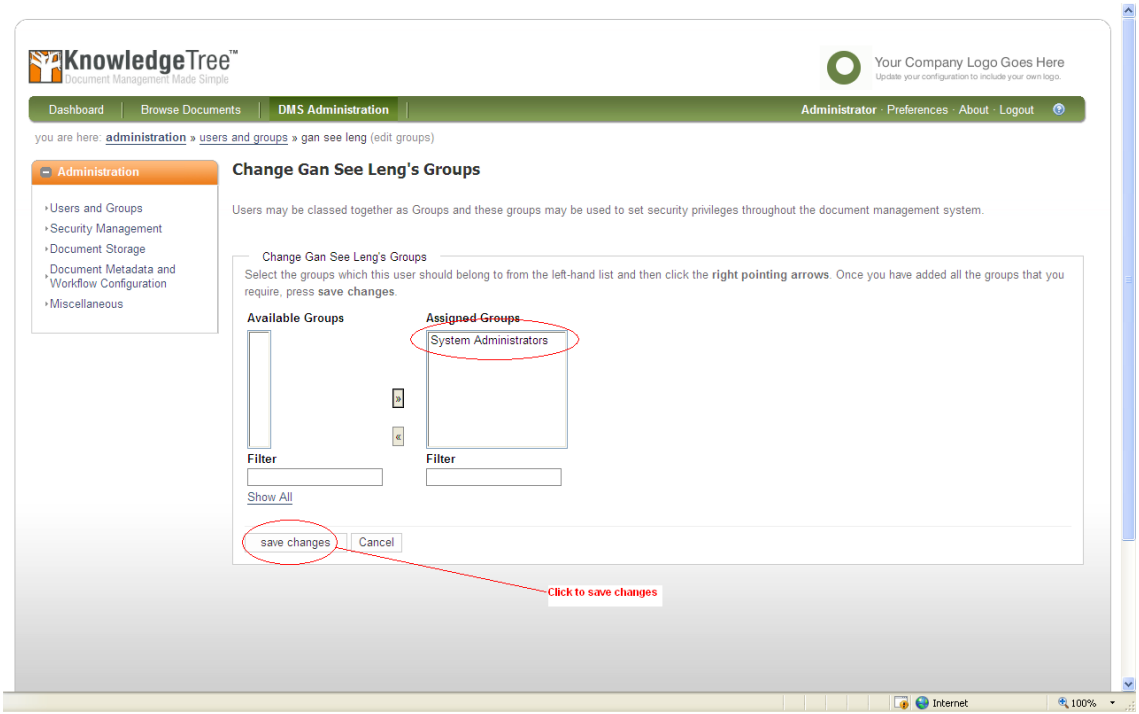

Figure 101: Screenshot of Users and Groups Management in KnowledgeTree (10)

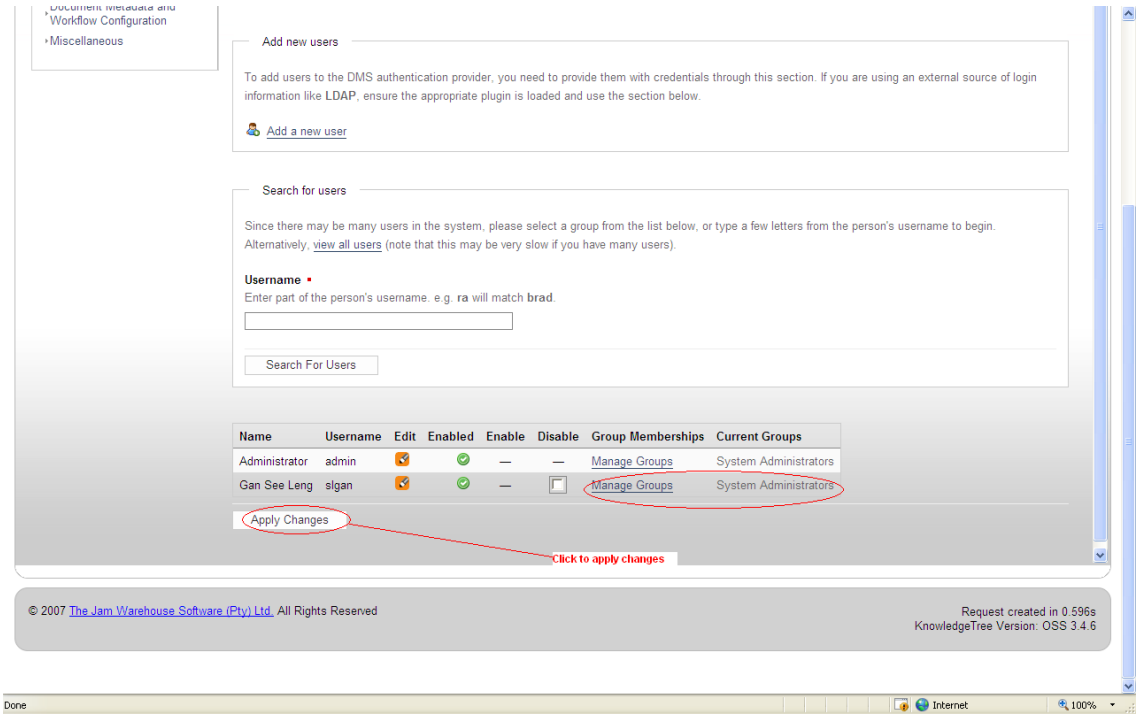

Figure 102: Screenshot of Users and Groups Management in KnowledgeTree (11)

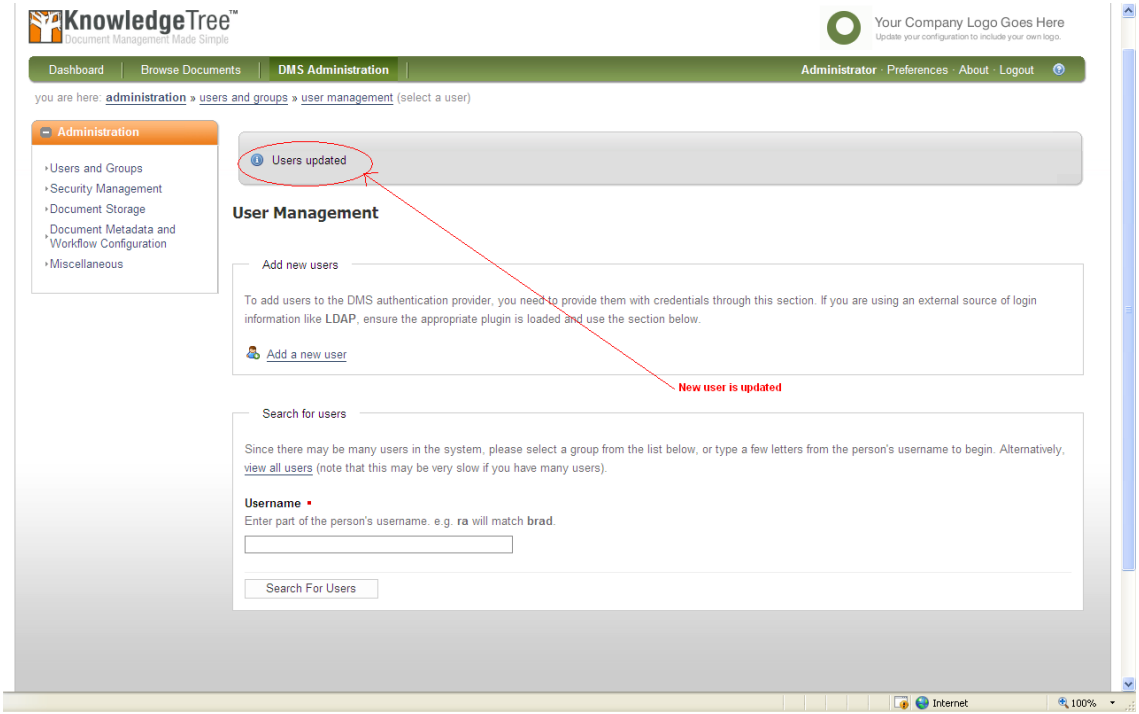

Figure 103: Screenshot of Users and Groups Management in KnowledgeTree (12)

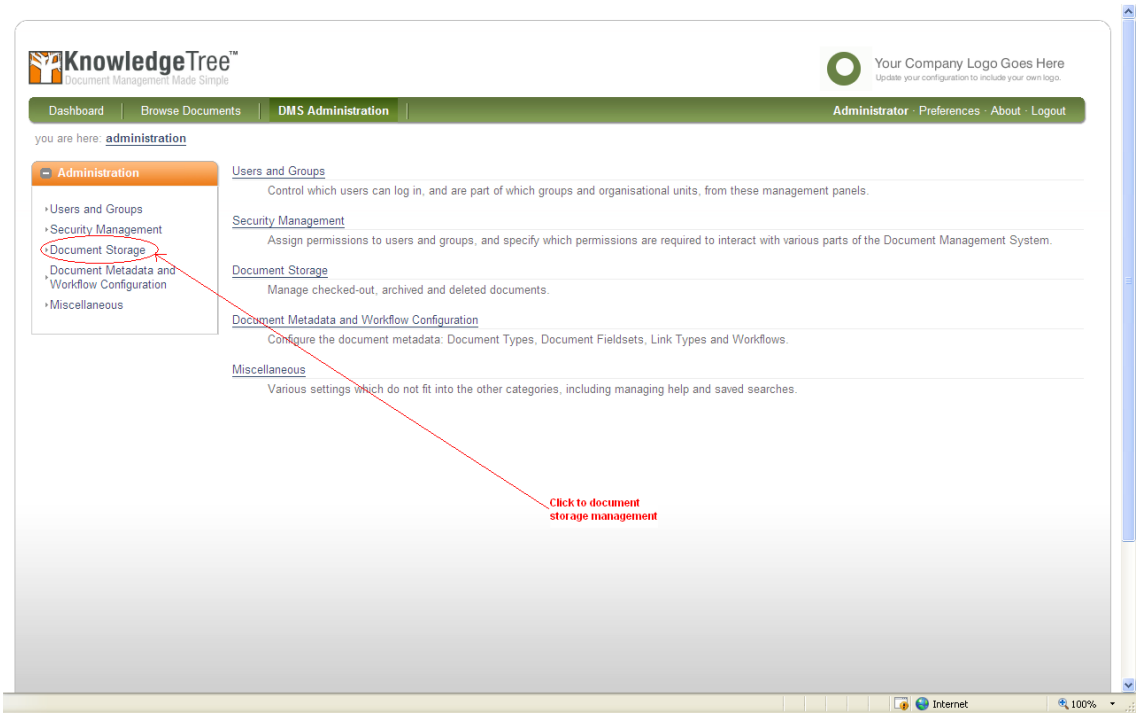

Figure 104: Screenshot of Document Storage Management in KnowledgeTree (1)

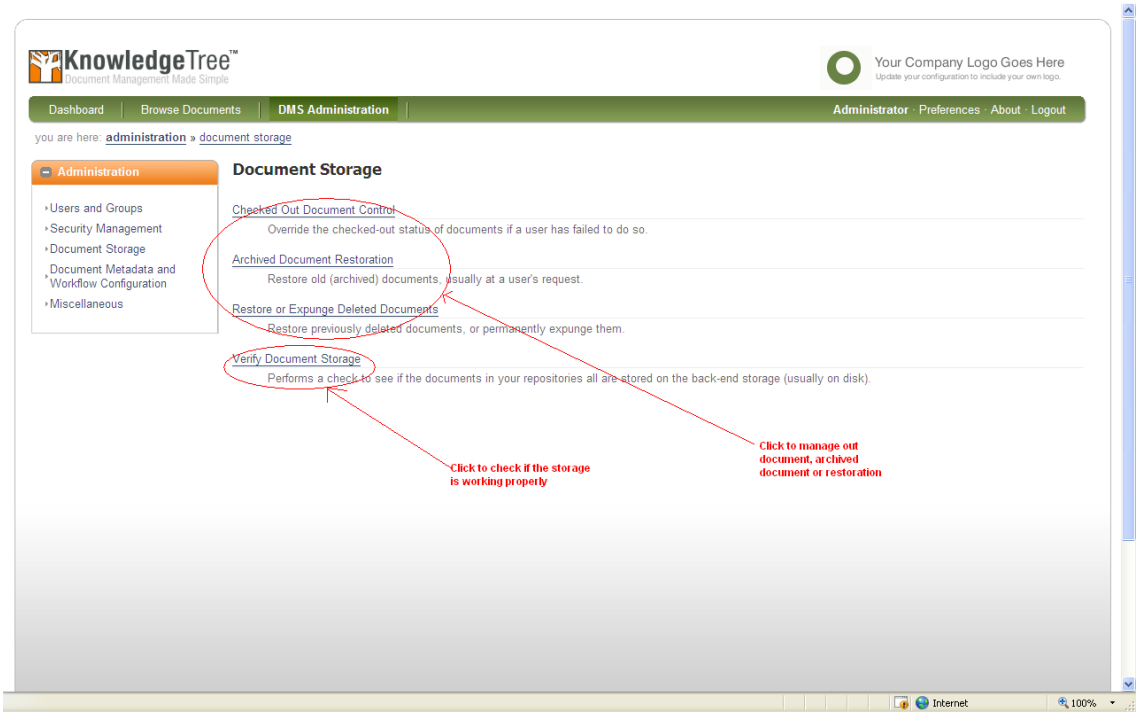

Figure 105: Screenshot of Document Storage Management in KnowledgeTree (2)

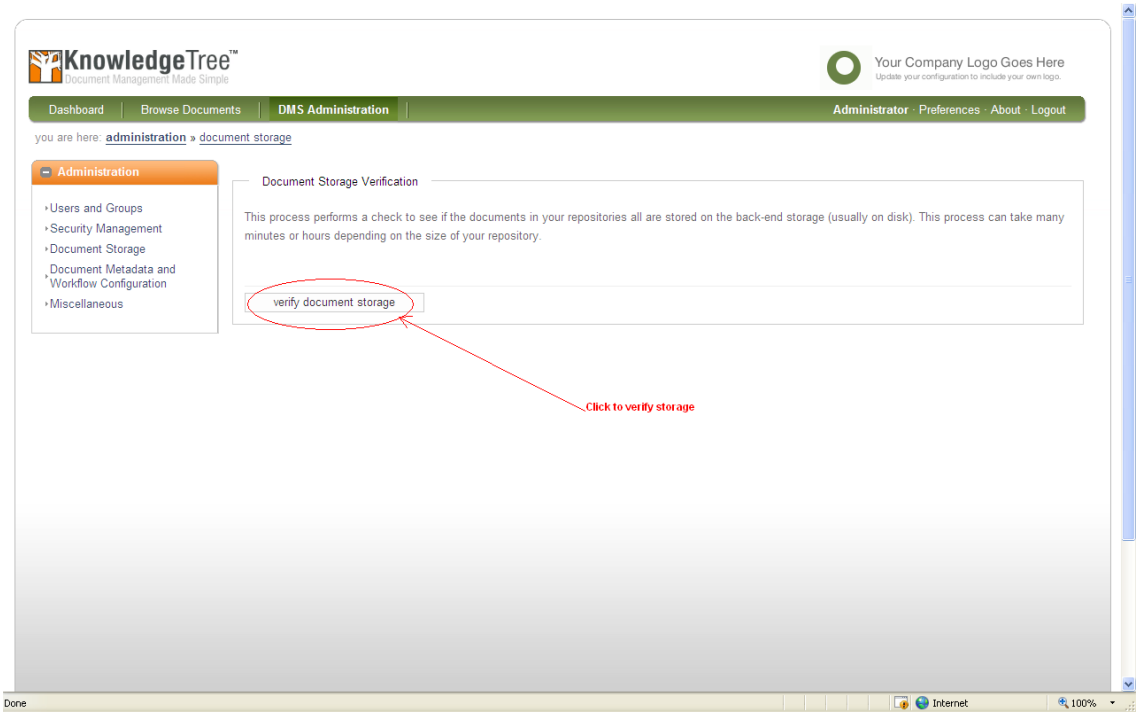

Figure 106: Screenshot of Document Storage Management in KnowledgeTree (3)

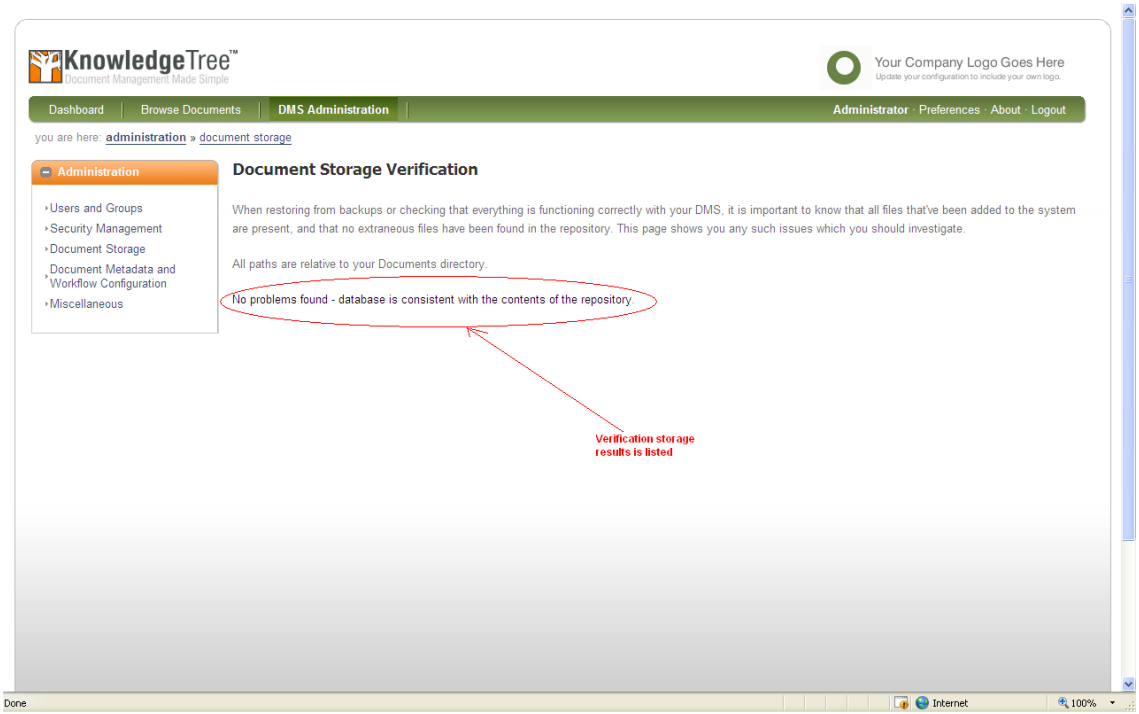

Figure 107: Screenshot of Document Storage Management in KnowledgeTree (4)

APPENDIX D

DATA DICTIONARY FOR KNOWLEDGE MANAGEMENT E-PORTAL

Database name: intranet for Drupal

Table structure for: access

Filed name	Data type	Field size	Extra
Aid	Tinyint	10	Primary
Mask	Varchar	255	Null
Type	Varchar	255	Null
Status	Tinyint	2	Null

Table structure for: accesslog

Filed name	Data type	Field size	Extra
Aid	Int	10	Primary
Sid	Varchar	32	Null
Title	Varchar	255	Null
Path	Varchar	255	Null
url	Varchar	255	Null
Hotname	Varchar	128	Null
Uid	Int	10	Null
Timer	Int	10	Null
Timestamp	Int	11	Null

Table structure for: aggregator_category

Filed name	Data type	Field size	Extra
cid	Int	10	Primary
Title	Varchar	255	Null
Description	Longtext	1	Null
Block	Tinyint	2	Null

Table structure for: aggregator_category_feed

Filed name	Data type	Field size	Extra
Fid	Int	10	Primary
cid	Int	10	Primary

Table structure for: aggregator_category_item

Filed name	Data type	Field size	Extra
Iid	Int	10	Primary
cid	Int	10	Primary

Table structure for: aggregator_feed

Filed name	Data type	Field size	Extra
Fid	Int	10	Primary
Title	Varchar	255	Unique
url	Varchar	255	Null
Refresh	Int	10	Null
Checked	Int	10	Null
Link	Varchar	255	Unique
Description	Longtext	1	Null
Image	Longtext	1	Null
Etag	Varchar	255	Null
Modified	Int	10	Null
Block	Tinyint	2	Null

Table structure for: aggregator_item

Filed name	Data type	Field size	Extra
Iid	Int	10	Primary
Fid	Int	10	Null
Title	Varchar	255	Null
Link	Varchar	255	Null
Author	Varchar	255	Null
Description	Longtext	1	Null
Timestamp	Int	11	Null

Table structure for: authmap

Filed name	Data type	Field size	Extra
Aid	Int	10	Primary
Uid	Int	10	Null
Authname	Varchar	128	Unique
Module	Varchar	128	Null

Table structure for: blocks

Filed name	Data type	Field size	Extra
Module	Varchar	64	Null
Delta	Varchar	32	Null
Theme	Varchar	255	Null
Status	Tinyint	2	Null
Weight	Tinyint	1	Null
Region	Varchar	64	Null
Custom	Tinyint	2	Null
Throttle	Tinyint	1	Null
Visibility	Tinyint	1	Null
Pages	Text	1	Null

Table structure for: book

Filed name	Data type	Field size	Extra
Vid	Int	10	Primary
Nid	Int	10	Index
Parent	Int	10	Index
Weight	Tinyint	3	Null

Table structure for: boxes

Filed name	Data type	Field size	Extra
Bid	Tinyint	4	Primary
Title	Varchar	64	Null
Body	Lontext	1	Null
Info	Varchar	128	Unique
Format	Int	4	Null

Table structure for: cache

Filed name	Data type	Field size	Extra
cid	Varchar	255	Primary
Data	Longblob	Binary	Null
Expire	Int	11	Index
Created	Int	11	Null
Headers	Text	1	Null

Table structure for: client

Filed name	Data type	Field size	Extra
cid	Int	10	Primary
Link	Varchar	255	Null
Name	Varchar	128	Null
Mail	Varchar	128	Null
Slogan	Longtext	1	Null
Mission	Longtext	1	Null
Users	Int	10	Null
Nodes	Int	10	Null
Version	Varchar	35	Null
Created	Int	11	Null
Changed	Int	11	Null

Table structure for: client_system

Filed name	Data type	Field size	Extra
cid	Int	10	Primary
Name	Varchar	255	Primary
Type	Varchar	255	Null

Table structure for: comments

Filed name	Data type	Field size	Extra
cid	Int	10	Primary
Pid	Int	10	Null
Nid	Int	10	Index
Uid	Int	10	Null
Subject	Varchar	64	Null
Comment	Longtext	1	Null
Hostname	Varchar	128	Null
Timestamp	Int	11	Null
Score	Mediumint	9	Null
Status	Tinyint	3	Null
Format	Int	4	Null
Thread	Varchar	255	Null
Users	Longtext	1	Null
Name	Varchar	60	Null
Mail	Varchar	64	Null
Homepage	Varchar	255	Null

Table structure for: contact

Filed name	Data type	Field size	Extra
cid	Int	10	Primary
Category	Varchar	255	Unique
Recipients	Longtext	1	Null
Reply	Longtext	1	Null
Weight	Tinyint	3	Null
Selected	Tinyint	1	Null

Table structure for: file_revisions

Filed name	Data type	Field size	Extra
Fid	Int	10	Primary
Vid	Int	10	Primary
Description	Varchar	255	Null
List	Tinyint	1	Null

Table structure for: files

Filed name	Data type	Field size	Extra
Fid	Int	10	Primary
Nid	Int	10	Null
Filename	Varchar	255	Null
Filepath	Varchar	255	Null
Filemime	Varchar	255	Null
Filesize	Int	10	Null

Table structure for: filter_formats

Filed name	Data type	Field size	Extra
Format	Int	4	Primary
Name	Varchar	255	Unique
Roles	Varchar	255	Null
Cache	Tinyint	2	Null

Table structure for: filters

Filed name	Data type	Field size	Extra
Format	Int	4	Null
Module	Varchar	64	Null
Delta	Tinyint	2	Null
Weight	Tinyint	2	Index

Table structure for: flood

Filed name	Data type	Field size	Extra
Event	Varchar	64	Null
Hostname	Varchar	128	Null
Timestamp	Int	11	Null

Table structure for: forum

Filed name	Data type	Field size	Extra
Nid	Int	10	Index
Vid	Int	10	Primary
Tid	Int	10	Index

Table structure for: history

Filed name	Data type	Field size	Extra
Uid	Int	10	Primary
Nid	Int	10	Primary
Timestamp	Int	11	Null

Table structure for: locales_meta

Filed name	Data type	Field size	Extra
Locale	Varchar	12	Primary
Name	Varchar	64	Null
Enabled	Int	2	Null
Isdefault	Int	2	Null
Plurals	Int	1	Null
Formula	Varchar	128	Null

Table structure for: locales_source

Filed name	Data type	Field size	Extra
Lid	Int	11	Primary
Location	Varchar	255	Null
Source	Blob	BINARY	Null

Table structure for: locales_target

Filed name	Data type	Field size	Extra
Lid	Int	11	Index
Translation	Blob	BINARY	Null
Locale	Varchar	12	Index
Plid	Int	11	Index
Plural	Int	1	Index

Table structure for: menu

Filed name	Data type	Field size	Extra
Mid	Int	10	Primary
Pid	Int	10	Null
Path	Varchar	255	Null
Title	Varchar	255	Null
Description	Varchar	255	Null
Weight	Tinyint	4	Null
Type	Int	2	Null

Table structure for: node

Filed name	Data type	Field size	Extra
Nid	Int	10	Primary
Vid	Int	10	Unique
Type	Varchar	32	Index
Title	Varchar	128	Null
Uid	Int	10	Index
Status	Int	4	Null
Created	Int	11	Null
Changed	Int	11	Null
Comment	Int	2	Null
Promote	Int	2	Null
Moderate	Int	2	Null
Sticky	Int	2	Null

Table structure for: node_access

Filed name	Data type	Field size	Extra
Nid	Int	10	Primary
Gid	Int	10	Primary
Realm	Varchar	255	Primary
Grant_view	Tinyint	1	Null
Grant_update	Tinyint	1	Null
Grant_delete	Tinyint	1	Null

Table structure for: node_comment_statistics

Filed name	Data type	Field size	Extra
Nid	Int	10	Primary
Last_comment_stamp	Int	11	Index
Last_comment_name	Varchar	60	Null
Last_comment_uid	Int	10	Null
Comment_count	Int	10	Null

Table structure for: node_counter

Filed name	Data type	Field size	Extra
Nid	Int	10	Primary
Totalcount	Bigint	20	Index
Daycount	Mediumint	8	Index
Timestamp	Int	11	Index